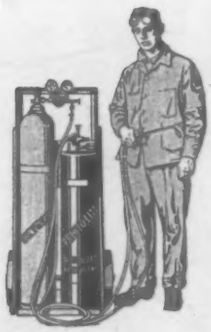
The Welding Engineer

Vol. II. Chicago 608 S. Dearborn St. JULY, 1917 $2.00 per year in U. S. $2.50 per year abroad No. 7

Prest-O-Lite

Acetylene Service



NO matter what use you make of acetylene, or what apparatus you now employ, Prest-O-Lite Acetylene Service offers you real co-operation of a helpful character.

The country-wide system of Prest-O-Lite Factory Branches, Charging Plants and Service Stations insures prompt, universal, perpetual service.

Prest-O-Lite, the purest form of carbide gas, is furnished in portable cylinders for welding and cutting, under our liberal service plan.

The advice and assistance of the Prest-O-Lite organization are a part of Prest-O-Life Service. We maintain, at important centers, staffs of men skilled in oxy-acetylene welding, who are at the disposal of users of the PREST-O-LITE PROCESS.

Our experts are ready to give practical advice and assistance—to point the best way to handle welding and cutting problems—in manufacturing, construction or repair work.

We furnish suitable welding and cutting equipment, materials and supplies for all classes of work.

Let us help overcome your welding and cutting difficulties. Prompt, expert attention given to all correspondence relating to your problems.

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U. S. Main Office and Factory, 851 Speedway, Indianapolis, Ind.
Canadian General Office, Dept. B. 1, Toronto, Ontario

59 Branches and Charging Plants in Principal Industrial Centers

World's Largest Makers of Dissolved Acetylene

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Oxweld Equipment includes Acetylene Generators, Welding and Cutting Blow Pipes, Regulators and Supplies—everything needed for all requirements—complete installations for the most extensive manufacturing and repair operations to portable units for emergency and field use. Because of the scientific accuracy and exactness of design—high quality materials and the mechanical perfection of construction and workmanship, **OXWELD EQUIPMENT** will produce the most efficient and economical results in welding and cutting operations of every character.

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Our knowledge and experience, as the largest makers of welding and cutting equipment in the world, are always at the service of every purchaser and prospective purchaser of **OXWELD APPARATUS,** to determine the most economical and efficient applications of the **PROCESS** to the manufacturing or repair problems at hand.

Write us for information on any class of Welding or Cutting Work

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The Welder's Delight—Made of fibre—an absolute Non-conductor of Heat. Light and durable.

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No. 511. Fitted with "Essentialite" Lenses. $1.50 per pair.

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Brazing
Straightening
Bending
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Simply because the Repair Force is
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Virtually every known application of
Incomparable Oxy-Acetylene Welding and
Cutting Equipment, which means
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Oxweld Railroad Service Co.
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Milburn mixing principle produces best work with minimum gas, and no flash backs, burnt tips, or other annoyances.

Exceptionally durable construction of torches insures long, satisfactory service. Regulators dependable and free from valve, diaphragm and gauge troubles.

Ask for Catalogue No. 35.

The Alexander Milburn Company
Baltimore, Maryland

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Commercial Acetylene Welding Co.
The Prest-O-Lite Co., Inc.
Universal Oxygen Co.

ACETYLENE CYLINDERS

ACETYLENE GENERATORS
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Davis-Bournonville Co.
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Superior Oxy-Acetylene Machine Co.
Vulcan Process Co.

ALUMINUM FILLER RODS
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Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Mach. Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

ALUMINUM FLUX
American Welding Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
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Vulcan Process Co.

ALUMINUM SOLDER
Vulcan Process Co.

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Buffalo Dental Mfg. Co.
Universal Oxygen Co.

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ASBESTOS GLOVES
Vulcan Process Co.

ASBESTOS SHEET PAPER
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Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

BLOW TORCHES (Acetylene)
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Hauck Mfg. Co.
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The Prest-O-Lite Co.
Vulcan Process Co.

BOOKS (Relating to Welding)
The Welding Engineer
P. F. Willis.

BRASS AND BRONZE FLUX
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The Imperial Brass Mfg. Co.
United States Welding Co.
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The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
Vulcan Process Co.

BRASS SPELTER WIRE
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Vulcan Process Co.

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Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

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Thomson Electric Welding Co.

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Canada Carbide Sales Co.
Union Carbide Sales Co.

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CARBO-HYDROGEN
Carbo-Hydrogen Co. of America

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The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
Messer & Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co., Inc.
Superior Oxy-Acetylene Mach. Co.
Universal Oxygen Co.
Vulcan Process Co.

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Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

CRANES (Portable)
H. G. Doran.

ELECTRIC ARC WELDING OUTFITS
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Westinghouse Electric & Mfg. Co.
General Electric Co.

ELECTROLYTIC OXYGEN PLANTS
Universal Oxygen Co.
Vulcan Process Co.

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Hauck Mfg. Co.
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The Prest-O-Lite Co.
Vulcan Process Co.

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Bierman-Everett Fdy. Co.
Bermo Supply Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
Steel Sales Corp.
Universal Oxygen Co.
Vulcan Process Co.

FILLER RODS (Tobin Bronze)
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Bermo Supply Co
Bierman-Everett Fdy. Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
Steel Sales Corp.
Vulcan Process Co.
United States Welding Co.
Universal Oxygen Co.

FILLER RODS (Vanadium Steel)
American Welding Co.
Bermo Supply Co.
Bierman-Everett Fdy. Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Steel Sales Corp.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

FIREPROOF PLASTIC
Bermo Supply Co.

FLUX WELDERS (Electric)
Westinghouse Electric & Mfg. Co.

FURNACES (Annealing)
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
Universal Oxygen Co.

GASOLINE PREHEATING FURNACES
Buffalo Dental Mfg. Co.
Hauck Mfg. Co.
The Prest-O-Lite Co., Inc.
Superior Oxy-Acetylene Machine Co.

GAS BURNERS (Preheating)
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
Westinghouse Electric & Mfg. Co.
Vulcan Process Co.

GLOVES (Welders Asbestos)
Davis-Bournonville Co.
Vulcan Process Co.

GOGGLES
William C. Adams.
Chicago Eye Shield Co.
F. A. Hardy & Co.
Vulcan Process Co.

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HARDENING FURNACES
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Hauck Mfg. Co.

HOSE (Carbo-Hydrogen)
Carbo-Hydrogen Co. of America

HOSE (Oxygen and Acetylene)
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Bermo Supply Co.
Buffalo Dental Mfg. Co.
Davis-Bournonville Co.
Imperial Brass Mfg. Co.
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The Prest-O-Lite Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

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Hauck Mfg. Co.
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Vulcan Process Co.

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Vulcan Process Co.

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Vulcan Process Co.

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Bermo Supply Co.
Buffalo Dental Mfg. Co.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Vulcan Process Co.

The Growth of Oxy-Acetylene Welding and Cutting and the Increasing Demand for Davis-Bournonville Apparatus

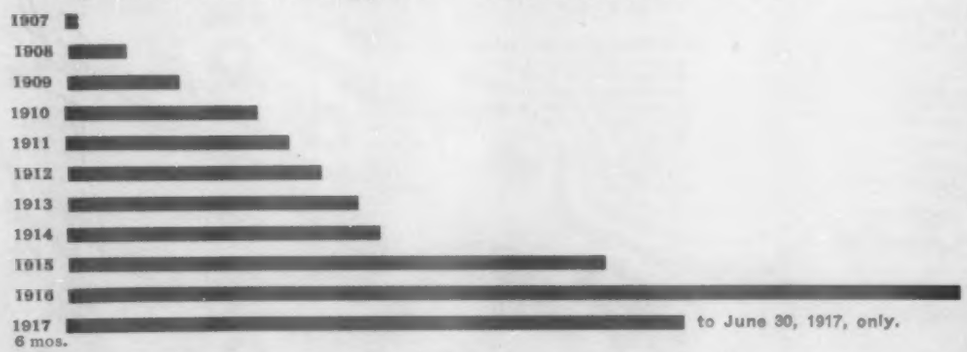
A Year Ago we said—

"The growth of Oxy-Acetylene Welding and Cutting in the United States is shown by the increasing use of Davis-Bournonville apparatus, which is inseparably associated with the development and success of the oxy-acetylene industry in this country.

"Ten years ago the process was unknown in the United States. Today it forms one of the great industries of the country, with its requirements for acetylene, oxygen and efficient apparatus.

"The Davis-Bournonville Company obtained the United States patents for the independent positive-pressure type of welding torch (mixing the gases in an interchangeable tip or nozzle) in 1906—basic principles which have been retained in the D-B torch because of their proven superiority through ten years of development, improvement and the most successful operation. "There is more Davis-Bournonville welding and cutting apparatus in successful use in the United States than of any other make, and the prominent concerns which have established the greatest success with this process have large installations of D-B apparatus, with from ten to one hundred or more torch units, and from one to six of the largest acetylene generators."

Today—The increasing use of the oxy-acetylene process for welding and cutting and of Davis-Bournonville apparatus are parallel and are graphically shown by the sales of "Davis Apparatus" as charted below:



"Davis Apparatus" Leads the World in Range, Efficiency and Number of Successful Users. Write for bulletins and information showing why it is used by the largest steel mills, foundries, ship-yards, locomotive and car builders, U. S. Navy Yards and government works, mines, sheet metal working factories, tube and barrel welders, scrap yards, and in hundreds of small repair shops and garages.

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General Offices and Factory, Jersey City, N. J.

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BOSTON	CLEVELAND		DETROIT	SAN FRANCISCO
PHILADELPHIA	CINCINNATI		ST. LOUIS	TORONTO, ONT. (Carter Welding Co.)

DAVIS-BOURNONVILLE CO. DAVIS APPARATUS NEW YORK-CHICAGO

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Oxweld Acetylene Co.
Superior Oxy-Acetylene Mach. Co.
Vulcan Process Co.

OXYGEN (Compressed in Cylinders)
Burdett Oxygen Co.
The Linde Air Products Co.
Swift & Co.
Universal Oxygen Co.
Vulcan Process Co.

OXYGEN CYLINDERS

PIPE WELDING
Goldschmitt Thermit Co.

PHOTOGRAPHS
Chicago Architectural Photographing Co., (Specialists in photographs relating to the welding industry)

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Bastian & Blessing Co.
Bermo Supply Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
U. S. Gauge Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

RAILROADS—Special Service for
Oxweld Railroad Service Co.

REGULATING VALVES (Acetylene)
American Welding Co.
The Bastian-Blessing Co.
Bermo Supply Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
The Prest-O-Lite Co., Inc.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

REGULATING VALVES (Carbo-Hydrogen)
Carbo-Hydrogen Co. of America

REGULATING VALVES (Hydrogen)
American Welding Co.
The Bastian-Blessing Co.
Bermo Supply Co.
The Prest-O-Lite Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
Vulcan Process Co.

REGULATING VALVES (Oxygen)
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American Welding Co.
Bermo Supply Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

SCHOOLS OF WELDING

SEAM WELDERS (Electric)
General Electric Co.
Westinghouse Electric & Mfg. Co.

SEAM WELDERS (Electric Resistance)
Thomson Electric Welding Co.

SPOT WELDERS (Electric Resistance)
Thomson Electric Welding Co.

TANK CONNECTIONS (Oxygen and Acetylene Adapters)
Superior Oxy-Acetylene Machine Co.

THERMALENE-GAS
The Thermalene Co.

THERMIT WELDING
Goldschmidt-Thermit Co.

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Carbo-Hydrogen Co. of America

TORCHES (Gasoline and Kerosene Preheating)
American Welding Co.
Alger Supply Co.
Buffalo Dental Mfg. Co.
General Welding & Eq. Co.
The Imperial Brass Mfg. Co.
Hauck Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Westinghouse Electric & Mfg. Co.
Vulcan Process Co.

TORCHES (Oxy-Acetylene Cutting)
American Welding Co.
Bermo Supply Co.
Davis-Bournonville Co.
General Welding & Eq. Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
Messer & Co.
Welding Supply Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co., Inc.
Superior Oxy-Acetylene Machine Co.
The Thermalene Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

TORCHES (Oxy-Acetylene Welding)
American Welding Co.
Bermo Supply Co.
Davis-Bournonville Co.
General Welding & Eq. Co.
The Harris Calorific Co.
Messer & Co.
Welding Supply Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co., Inc.
Superior Oxy-Acetylene Machine Co.
The Thermalene Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

TORCHES (Oxy-Hydrogen Cutting)
American Welding Co.
Bermo Supply Co.
Davis-Bournonville Co.
Messer & Co.
Welding Supply Co.
General Welding & Eq. Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Alexander Milburn Co.
The Imperial Brass Mfg. Co.
Vulcan Process Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

TORCHES (Oxy-Hydrogen Welding)
American Welding Co.
Bermo Supply Co.
Messer & Co.
Welding Supply Co.
Buffalo Dental Mfg. Co.
Davis-Bournonville Co.
Vulcan Process Co.
General Welding & Eq. Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
United States Welding Co.
Universal Oxygen Co.

TORCHES (Special to Order)
American Welding Co.
Bermo Supply Co.
The Harris Calorific Co.
Superior Oxy-Acetylene Machine Co.
Vulcan Process Co.

TRUCKS (Cylinder Carriers)
American Welding Co.
Davis-Burnonville Co.
M. Desmond Mfg. Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Vulcan Process Co.

VALVES (For Oxygen Cylinders)
The Bastian-Blessing Co.
Universal Oxygen Co.
Vulcan Process Co.

WELDING (Electric Resistance-Custom Work)
Thomson Electric Welding Co.

WELDERS' GOGGLES
Chicago Eye Shield Co.
F. A. Hardy Co.
Vulcan Process Co.

WELDING (Oxygen for)
The Linde Air Products Co.
Universal Oxygen Co.
Vulcan Process Co.

WELDING RODS
Bierman-Everett Fdy. Co.
Vulcan Process Co.

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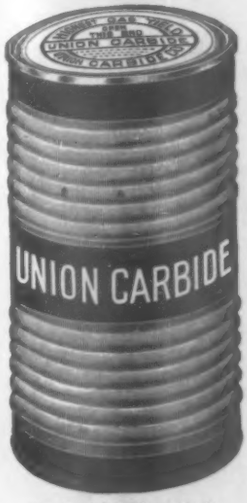

Packed in Blue and Gray Drums

Union Carbide Sales Company

New York City, 42nd St. Building | **Chicago, Ill., Peoples Gas Building** | **San Francisco, Cal., Kohl Building**

SOLE DISTRIBUTORS OF

UNION CARBIDE

"World's Best Quality—Highest Gas Yield"

For Oxy-Acetylene Welding Plants

Contractors' Flare Lights, Torches and Private and Municipal Lighting Plants

"Union Carbide" is packed in 100-lb. blue and gray drums marked conspicuously, "UNION CARBIDE."

The following sizes are carried in stock in 100-lb. drums:

$3\frac{1}{2}$ x 2 in. —a large size.

$1\frac{1}{4}$ x $\frac{3}{8}$ in. —an intermediate size.

2 x $\frac{1}{2}$ in. —a medium size.

$\frac{1}{4}$ x 1/12 in. —finely crushed size.

Union Carbide in the Generator sizes above listed will be shipped direct to consumers from a **Union Carbide Sales Co.** warehouse at any one of the following points where large stocks are kept on hand:

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Birmingham—1916 Morris Ave.
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ARIZONA
Phoenix—42 S. Central Ave.
ARKANSAS
Fort Smith—109-123 So. Ninth St.
CALIFORNIA
Eureka—109 Second St.
Fresno—932 H St.
Los Angeles—639 Gibbon St.
Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
San Francisco—Kohl Building.
COLORADO
Denver—Nineteenth and Wazee Sts.
Victor—Third and Diamond Sts.
CONNECTICUT
Hartford—877 Main St.
DISTRICT OF COLUMBIA
Washington—Maryland Ave. and 9th St., S. W.
FLORIDA
Jacksonville—106 E. Forsyth St.
Tampa—413 Tampa St.
GEORGIA
Atlanta—Cor. Haynes and Rhodes Sts., P. O. Box 1594.
Savannah—Ogeechee Canal, South of Bay St., P. O. Box 78.
ILLINOIS
Chicago—Peoples Gas Bldg., Michigan Blvd.
Decatur—133-147 W. Williams St.
East St. Louis—490 Walnut Ave.
Peoria—731-731 So. Washington St.
Marion—315 S. Granite St., Box 747.
Monmouth—521 S. First St.
Quincy—222 S. Eighth St.
Streator—702 East Elm St.
INDIANA
Evansville—1601 Illinois St.
Indianapolis—110-112 S. Alabama St.
Terre Haute—921 Wabash Ave.
IOWA
Des Moines—117-119 Fifth St.
Dubuque—8th and Washington Sts.
Ottumwa—307-9-11 S. Washington St.
Sioux City—925 Fourth St., P. O. Box 398.
KANSAS
Pittsburg—109 W. Third St.
Salina—164 So. 5th St.
Wichita—731 Beacon Building.
KENTUCKY
Louisville—126 E. Main St.
Middlesboro—
LOUISIANA
New Orleans—819-21 Julia St.
MAINE
Portland—202 Commercial St.
MARYLAND
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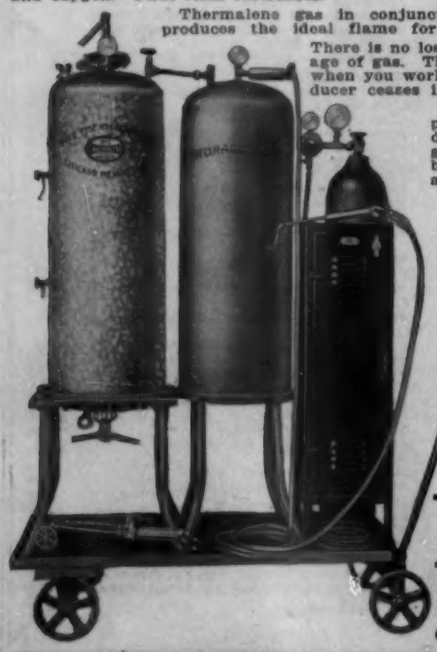

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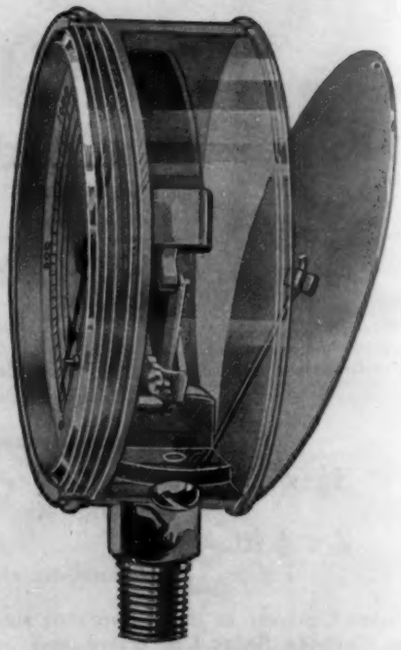

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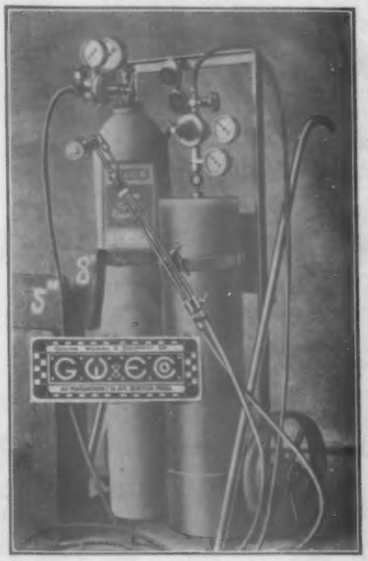

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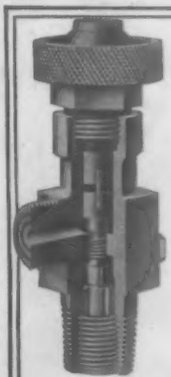

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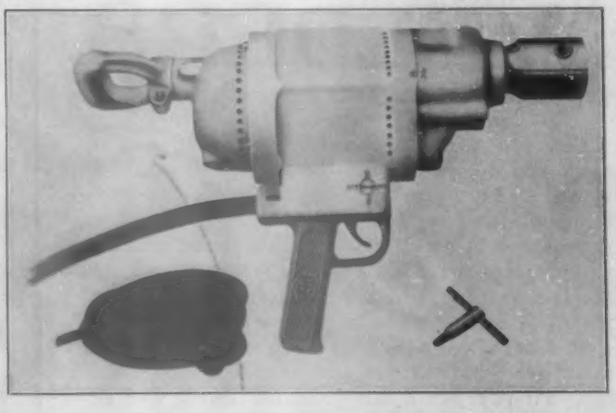

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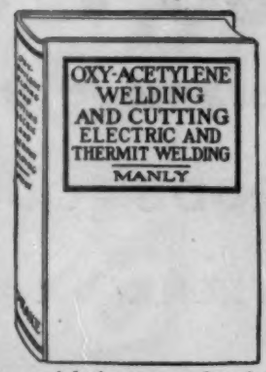

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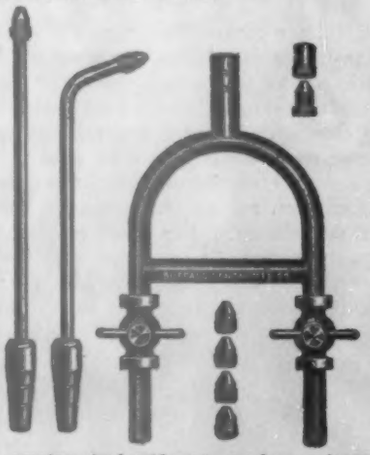

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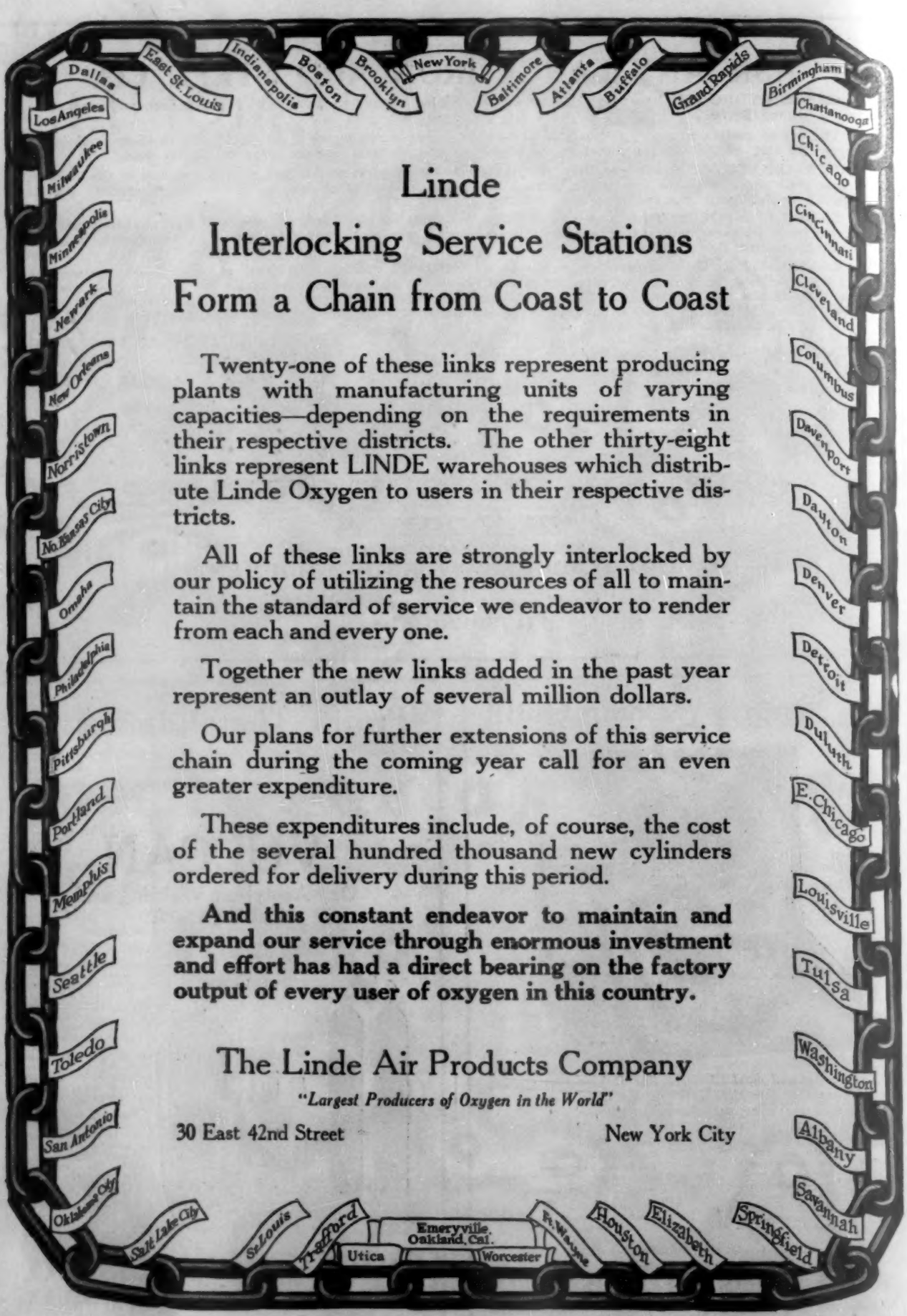

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ELECTRIC SPOT-WELDING OPERATIONS *on* AUTOMOBILE LAMPS*

SYNOPSIS—This article shows some of the electric spot-welding operations that enter into the manufacture of automobile lamps. This welding method enables the lamps to be reinforced where necessary and simplifies some difficult manufacturing operations.

The C. M. Hall Lamp Co., of Detroit, Mich., manufactures a variety of lamps for automobiles. In many of the operations necessary to the turning out of these accessories Toledo and Detroit electric spot-welding machines are employed to advantage. In Fig. 1 are shown some of the lamps manufactured at the Hall company's factory. Reading from left to right, the two end ones are license tail lamps, the next is a double head light, and in front of this latter is a tail light. In front of the double lamp is a side lamp, the others representing two styles of single head lights made up for some of the smaller cars. A body and the body ring as used on each lamp are shown in Fig. 2. The ring is slipped over the body and secured to it by means of three electric spot welds.

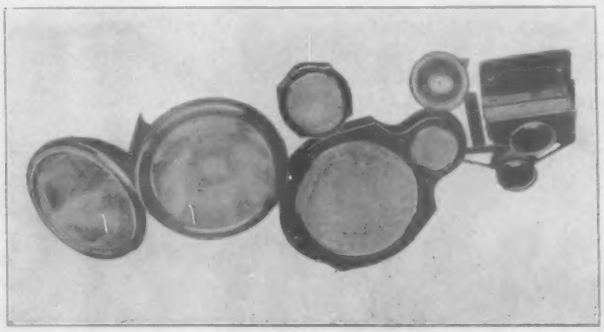


Fig. 1—Some Completed Lamps.

One of the parts after this operation is shown in Fig. 3. The body and ring are made from 0.031-inch (No. 22 gauge) steel, and the average time required to make the three welds is ¼ minute.

Welding Stiffener and Stud.

The body stiffener is made of two sheets of 0.0375-inch (No. 20 gauge) steel. Two of these already formed and blanked to size are shown in Fig. 4. The two plates are placed together and united with two spot welds as shown in Fig. 5. The time required to place two of these sheets together and make the weld is approximately ¼ minute.

In Fig. 6 are shown one f the studs and the stiffener parts. After the two sheets which comprise the stiffener have been welded together, the opening and the hole are punched out; two depressions are also made in the part. One of these elements after these operations have been performed is shown at the right of the illustration. The stud

*By courtesy of the American Machinist.

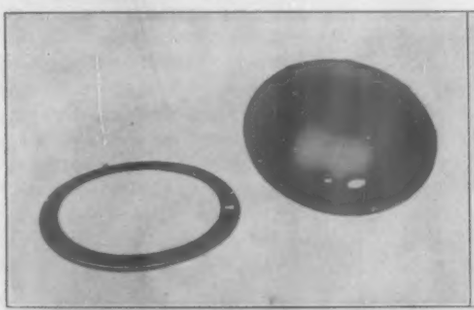


Fig. 2—Body and Body Ring.

Fig. 3—Welded Ring.

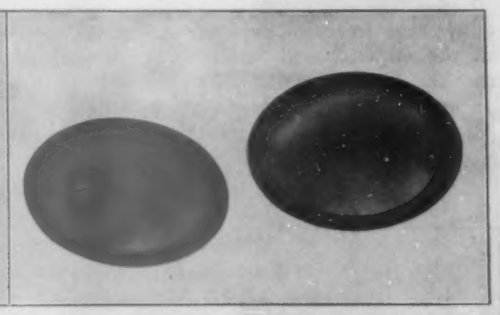


Fig. 4—Body Stiffener Plates.

Fig. 5—The Welded Stiffener.

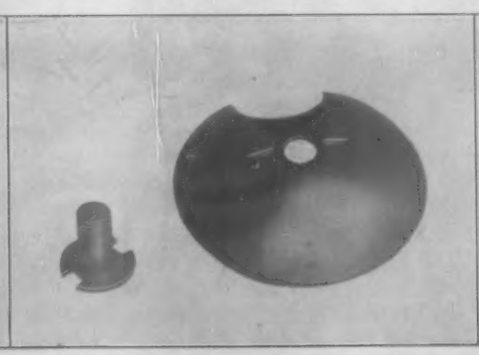


Fig. 6—Stud and Stiffener Parts.

Fig. 7—The Stud Attached.

is placed in the hole of the stiffener and attached to it with four spot welds.

One of the stiffeners with stud welded in position is shown in Fig. 7. The time required to make the four welds is ½ minute. The body connection is made to the shape shown in Fig. 8 at *A*, and the retainer as shown at *B*. The connection is then slid into the retainer as shown at *C* and attached to it with two welds. Both the connection and the retainer are made of 0.031-inch (No. 22 gauge) steel.

The stiffener stud is slid into the hole in the crown of the lamp body and attached to it with seven spot welds. The retainer is also slid into a hole at the side of the lamp body and held to the stiffener with three welds.

The time necessary to spot weld the stiffener and retainer in the lamp body is 1 minute. One of the lamp bodies with the stiffener and retainer spot welded in position is shown in Fig. 9. When making the body ring the three clips are attached to it with the electric welder.

At the left of the illustration, Fig. 10, is shown one of the rings, which is 0.0312-inch (No. 22 gauge) thick, and three of the clips, which are 0.078-inch (No. 14 gauge) thick. The three clips are then attached to the ring, two spot welds being used for each clip. The time necessary for the operation is 1 minute. One of the rings with the clips attached is shown at the right of the illustration.

The body prop is made in two parts, the part proper and a plate, as shown at *A* and *B*, Fig. 11. The stiffener is then placed in the prop and united to it with three spot welds. One of the pieces with the stiffener welded in position is shown at *C*. The average time necessary for placing the stiffener in the prop and making the three spot welds is somewhere in the vicinity of 1 minute.

In Fig. 12 is shown a body band to which a stiffener is spot welded. The band is 0.031-inch (No. 22 gauge) and the stiffener is 0.0625-inch (No. 16 gauge.) To attach the stiffener to the band five spot welds are used, and the average time required is 1 minute.

When making the license plate and glass retainer the latter is attached to the plate with three spot welds. The plate is 0.031-inch (No. 22 gauge) and the retainer 0.05-inch (No. 18 gauge). The two elements used for this part are shown at *A* and *B*, and one with the retainer attached is shown at *C*, Fig. 13.

When making the lamp body and license plate the two elements are attached by means of spot welding.

In Fig. 14, at the left, are shown one of the bodies and license plates. The body is 0.031-inch (No. 22 gauge) and the plate 0.0625-inch (No. 16 gauge). The two parts are attached with three spot welds, one of them after the operation being shown at the right. The average time necessary for welding is 1 minute.

Another type of lamp has the prop attached to it with the electric welder. The body and prop for this lamp are shown at *A* and *B* in Fig. 15.

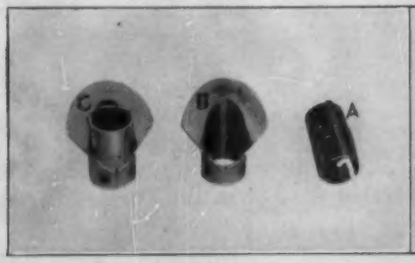


Fig. 8—Welded Connections.

Fig. 9—Lamp Body.

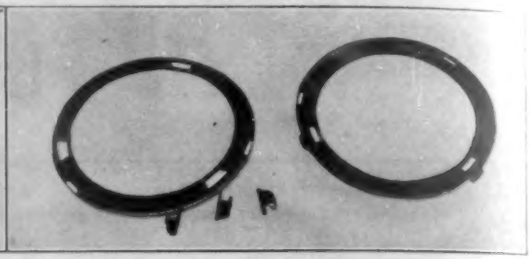


Fig. 10—Welded Body Ring.

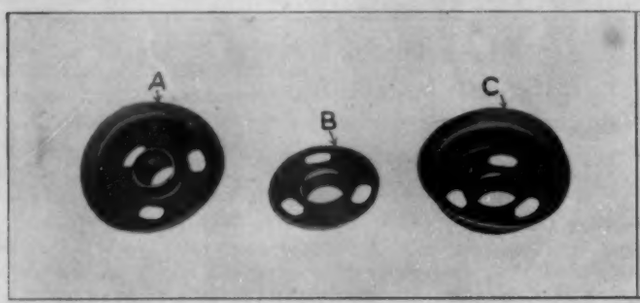


Fig. 11—Welded Body Props.

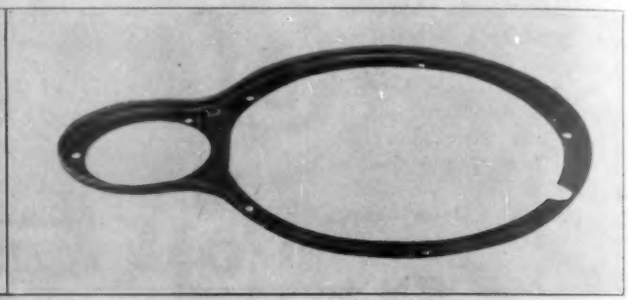


Fig. 12—A Welded Body Band and Stiffener.

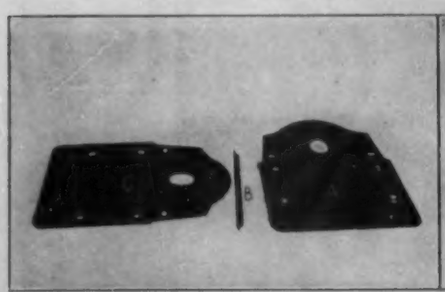


Fig. 13—License Plate.

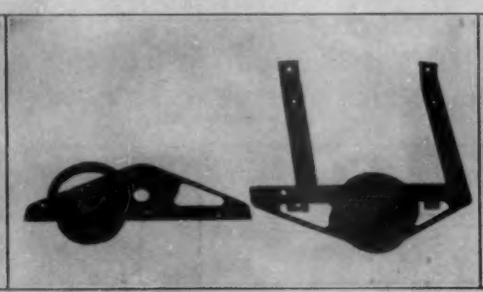


Fig. 14—Welded Body and Plate.

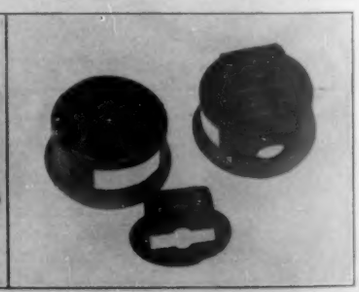


Fig. 15—A Body and Prop.

The WELDING *of* LOCOMOTIVE CYLINDERS

By B. Kopferschmidt

In visiting some of our modern railroad shops in the United States and Canada I have found that the oxy-acetylene welding and cutting process is well represented with the best equipment, supplies and workmanship. I notice, however, in many of these shops the lack of a progressive leader to advance the trade in going a little further than the other fellow.

In the April, 1917, issue of *The Welding Engineer,* I suggested what the duties should be for a foreman or master welder in a shop where ten or more welders are employed. In addition to his regular duties in teaching his men how to handle the blowpipe, he must work his mind along engineering lines on bigger operations and new production work, and to reduce such portions to his men to an exact science, the same as the blue print to a machinist.

In one of the best oxy-acetylene shops I noticed a few machinists were working on a broken locomotive cylinder at the port holes and around the flange, by applying a heavy bronze patch, secured to the cylinder with patch bolts. Considering that this is a successful operation in reclaiming the defective cylinder without removing it from the locomotive, the cost of making and applying the patch should be about twenty times higher than the welding operation. In addition to this, the time required to keep the locomotive with the defective cylinder in the shop is from ten to twenty days, whereas with the oxy-acetylene welding process, the maximum time required would be thirty-six hours as follows:

Preheating, four hours; machining or chipping, from four to nine hours; actual welding, three to seven hours, and cooling, sixteen hours. From these figures one can see that with the slow mechanical process it is necessary to keep a locomotive with a broken cylinder out of service from seven to seventeen days more than it would require to reclaim the same cylinder with the oxy-acetylene welding process. This loss of time is prohibitive, especially at the present, when power is so short.

Considering that the patch mechanically applied is not successful, as some of my railroad friends have experienced, then this cylinder is a continuous source of expense for maintaining, until finally the cylinder is removed and a new one replaced. The cost of the latter operation is $1,000, and it is quite an item to any railroad shop. To such operations where enormous savings could be obtained, the master welder must concentrate his abilities and enter the rank of the reclamation engineers.

The Difficulties Encountered.

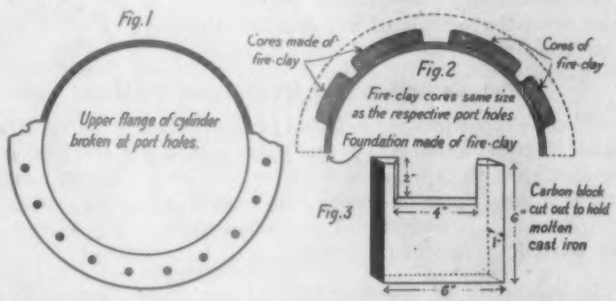
The difficulties encountered by some welders which cause them to shrink from the welding of a cylinder without removing it from the locomotive are the following:

The realization of vertical welds, the hardness of the metal, the expansion and contraction problem, the necessity of welding for a long time over a preheating oven, the forming of blow holes.

The Realization of Vertical Welds.

The majority of oxy-acetylene welders in this country have a settled opinion that on account of the fluidity of the metal when melted it does not allow the realization of vertical welds, and that it is therefore necessary to arrange the line of welding as nearly horizontal as possible, which with certain shapes of breaks in a cylinder, without removing it from the locomotive, is impossible, or very difficult. According to the latter theory it would be impossible to make such welds, but there is no reason why one could not see a little further and surround or hold up the edges to be welded with properly shaped carbon blocks, which act like a mould and thus prevent the moulten cast iron from flowing away. If any port holes are to be left open, then make cores of fire clay and set them wherever it is necessary.

Some time ago the writer repaired a broken cylinder by building up an entire new half of flange, as per Fig. 1, by the following method: The port holes on both ends of cylinders were plugged with asbestos or fire clay, then bricks were set at the defective end of cylinder so as to make a sort of platform around the half broken circle. On top of these bricks a fire clay foundation was built, corresponding in size with the good half of flange, as per Fig. 2. On top of this



foundation four cores also of fire clay were set at proper distances, as per Fig. 2. Then carbon blocks were cut out on the ends, as per Fig. 3, so as to make up the outside welds of the flange and cylinder. These carbons are six inches square and one inch thick It required 21 such carbon blocks to make up the whole half of circumference of the flange. Care was taken to numerate these blocks from 1 to 21. These carbon blocks were not set in place, but were laid aside and used only when the cylinder was preheated and ready for welding. Then we had the numbers *1* and *21* set on the clay platform and started on the break, having of course two operators, one on each side of break. When they filled the spaces of No. 1 and 21 carbons the No. 2 and 20 were applied on top of No. 1 and 21, and continued so until the last top carbon was reached and the job was finished, which took seven hours.

The preheating was performed as follows: Place two or four wooden blocks directly underneath the cylinder, the number of blocks depending on the distance of the cylinder to the ground. Cover these with ⅜-inch or ¼-inch sheet steel big enough to form an ample platform for the furnace. On this plate come two rows of bricks covered with fire clay. Then build brick walls all around the cylinder, leaving eight inches or more, if possible, for fuel displacement.

The first row of bricks should be set leaving one inch distance between the bricks for draft purposes. The bricks in the following rows may be placed close together and across each other. At the defective end, a space about 25 square inches, was left open and covered with sheet asbestos. Through this opening the operator was able to perform his work. The height of the furnace above the flange should not extend more than two inches. Then the furnace is filled completely with charcoal and with the use of a welded blowpipe the fuel is kindled through each of the bottom spaces between the bricks. After waiting thirty minutes for the fire to start well, the top openings should be closed with sheet asbestos, then it is necessary to wait four or five hours and the cylinder flange should be cherry red and ready for welding. The white space between the dotted lines and cores and platform, on Fig. 2, is to be filled with cast iron and at the same time it is united with the wall of the cylinder. The space between cores will build the bridges that separate the port holes and reinforces the flange. The fire clay platform and cores should contain, when mixed with water, about one per cent of borax or granulated glass, as this will eliminate the cracking of the cores during the preheating and welding operations. This operation is about the hardest specimen of cylinder welding and, if followed according to the outlined methods, any experienced welder can weld successfully a locomotive cylinder without removing it.

The Hardness of Metal.

If one uses cast iron welding rods from a reliable firm and a netural powerful flame, so as to keep the metal almost in a continuous fluidity, then the metal built on will be soft, the same as any other gray iron.

It is also important to avoid drafts going through the cylinder during the welding operation. The air draft will act upon the surface of hot cast iron the same as water acts on a hot chisel.

The Expansion and Contraction Problem.

If the proper method is followed in preheating the cylinder and if after welding, all the holes and open crevices are closed up with fire clay and left to cool slowly for 16 hours, there is no danger of cracking or even warping the cylinder. Of course, it is understood that when the welding operation is started, it must be continued until it is finished.

The Necessity of Welding for a Long Time Over a Preheating Furnace.

The necessity of welding for a long time over a preheating furnace renders the work, of course, a little difficult and tedious, but an ambitious welder soon gets used to holding the blowpipe with arms outstretched and in this position making the heaviest welds. However, he must have a long handled blowpipe and if not used to such work, he may be relieved about every hour. Pieces of sheet asbestos placed in front of the operator effects also a good protection from the heat. The welding rods should also be welded together so as to be about 5 feet long.

The Forming of Blow Holes.

Blow holes will be formed in the structure of the metal only if some gases are imprisoned in the metal or when the flame is not powerful enough to keep the metal in a molten condition at least ¼ inch deep. In the study of gas influence to cast iron during the welding operation, one can trace with a miscroscope the difference in crystalline structure between the outer rapidly cooled and the inner slowly cooled zones of a weld. The crystallites of iron first separate out and freeze at the molten surface and at right angles to it. The imprisoned gases thus cannot escape out on the surface, but they travel to the hot zones in the middle of the weld which are the last to freeze, and if there is no way for them to escape, produce gas cavities or blow holes. But if the surface of a weld is always kept about ¼ inch deep in a molten stage, then the gases will escape on the surface and so on until the weld is finished.

Editor's Note: Some difference of opinion seems to exist as to the advisability of welding locomotive cylinders in place. The reader is reminded, however, that the process Mr. Kopferschmidt describes is used constantly in the welding shop over which the author presides.

COST OF MOTOR REPAIRS

A writer in a recent issue of *The Scotsman* says:—"There is a certain type of motor advertisement that appeals to the man of moderate means. It contains two sets of highly dramatic pictures. On one side is a broken cylinder, a burst gear-box, or a fractured crankshaft; on the other are these articles rendered equal to new by the simple and (presumably) inexpensive process of oxy-acetylene welding. No longer is it necessary to buy expensive new parts from the makers. Suffice it to send the damaged part to a specialist in welding, and it is returned equal to new for a tithe of the cost. So I wrote a correspondent, and no doubt others, have fondly imagined. But my simple faith in the benevolence of the welding specialist has received a rude shock. In March I chanced to be away from home when an unexpected sharp spell of frost froze the water left in the radiator and cylinders. Result, one cylinder developed an angular crack some four inches long. I took off the cylinder and sent it to a welding specialist. A new cylinder would have cost about £4 10s. The welder's account came to £3 19s, 9d. (that looks so much better than £4). Then there was 7s. for carriage, and exactly seven weeks' delay. The account received stated that the sum charged was for welding and 'machining.' The 'machining' consisted of applying a coarse file to the outside of the welded part. Frankly, I never saw such unskilled filing in my life. No doubt the welder assumed that anyone so innocent as to send him a job would not know the difference between 'machining' and amateur filing. A few other details were equally unsatisfactory. The inside of the cylinder was red with rust, and much labor was necessary to restore it to a tolerable state. A sticky varnish had been smeared on all the studs on the cylinder, with the result that the threads of the screwed parts were choked up, and the nuts would not fit. Over an hour was spent in trying to burn the varnish off those screws with the aid of a blow-lamp. So far as I can judge, 15s. or £1 would have represented a profitable charge for this repair, but the welding specialist is obviously out for plunder, and means to have it now that motor manufacturers are busy with war material. It is a case of making hay while the sun shines. Personally I shall hereafter fight shy of the oxy-acetylene process as practised by philanthropic London specialists." *Acetylene & Welding Journal* (*England*).

The General Welding and Equipment Co., 107 Massachusetts Avenue, Boston, have issued two pamphlets. The first covers a line of equipment for welding and cutting metals of all kinds with the oxy-acetylene torch. The different standard types of apparatus are illustrated and briefly described, together with the regulators and torches employed. The other pamphlet is concerned with the cutting of iron or steel by this process and contains data on the cost of removing risers from steel castings in foundries and the cutting up of boilers, structural shapes and shafting in scrap yards.

The year book of the International Acetylene Association has been issued. It contains the proceedings of the 17th and 18th Annual Conventions.

WELDED CONTAINERS

The Author is Especially Well Qualified to Discuss the Question of Pressure Welding. He has Taken an Active Part in the Discussions of the American Society of Refrigerating Engineers, Before Whom this Paper was Read

By Charles S. Hollup

This paper was written with the intention of outlining welding methods, construction and preparation of work to be welded, tests as to safety and strength of welds, and practical application of welded work in the manufacture of refrigerating machinery.

The welding of metals other than steel and iron, and figures as to cost of welded work and details of welding apparatus, has been eliminated for reasons of unimportance at this time, as we are most interested in the safe construction of welded pressure containers.

The three methods of welding that I am best acquainted with, and perhaps most commonly used by the majority in our line of work, are Electric Resistance Welding, Electric Arc Welding and the Oxy-Acetylene Welding.

Each one of these processes has its field of most usefulness, while there is a sufficient overlap in the profitable application of each. Beyond the fact that electric current is used for obtaining the welding temperature, the two kinds of electric welding have no similarity.

The Electric Resistance Welding, the principle of which was discovered by Elihu Thompson, involves the passage of electric current thru the abutting ends of two pieces of metal to be welded. It is most exclusively used for butt welding pipe ends in the construction of pipe coils.

In preparing the pipe ends which have to be welded, care must be taken to have clean surfaces of contact, and square ends without burrs or upsetting, so as to assure a solid weld thru the full cross-section of the metal, and to eliminate a reduction of the area of pipe opening. As the current heats the pipe ends to a welding temperature, pressure is applied, to force the ends together until a complete union or weld is effected. The slight upsetting on the outside, due to the pressure applied, is smoothed down by a pair of tongs, the jaws of which are bored out to the outside diameter of the pipe, and by a rotary motion of the tongs, the heated section is smoothed over. After a little practice, when the operator has become familiar with the proper heat, he will produce a weld that will allow it to be bent to a return bend of reasonable center distance.

In practical experience, I have found that there is less than 1 per cent of welds that leak. In one lot of coils consisting of 1,280 welds, we did not have a single leak. * * *

Electric Arc Welding, has found a larger field of usefulness, and is running an even race with Oxy-Acetylene Welding; by which I mean to say, that for some classes of work, each will show some advantages over the other, and experience will have to teach where to draw the line.

In welding the various pieces that are going in a refrigerating plant, it is absolutely necessary to produce the best welds possible, in order to protect life and property from the dangers of failures. In electric arc, as well as acetylene welding, human element has to be taken into consideration. Wherever this has to be considered, it should not be left to the inexperienced to do responsible work. In this regard, I will say that electric arc has the advantage over acetylene welding, as far as I have found it in practice.

To produce a good electric weld, it is important that the operator has a steady hand to keep the arc going, and use the proper amount of current for a given thickness of metal, which can easily be determined by the supervisor.

In acetylene welding, it is not only necessary to get the proper hand movement, but the operator must also see that the material worked on is brought to a running heat, before any attempt of adding new metal is made. This is one point which I have found in my 11 years' experience, to be most difficult to overcome by beginners, and perhaps the one that causes the most failures. Another factor nearly just as important, is the proper adjustment of the flame, which has

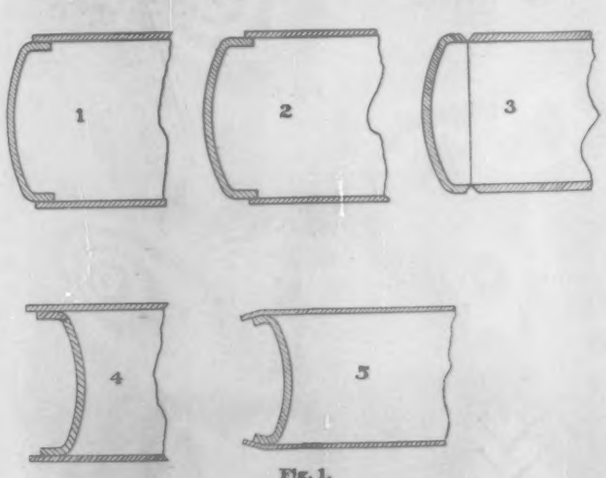


Fig. 1.

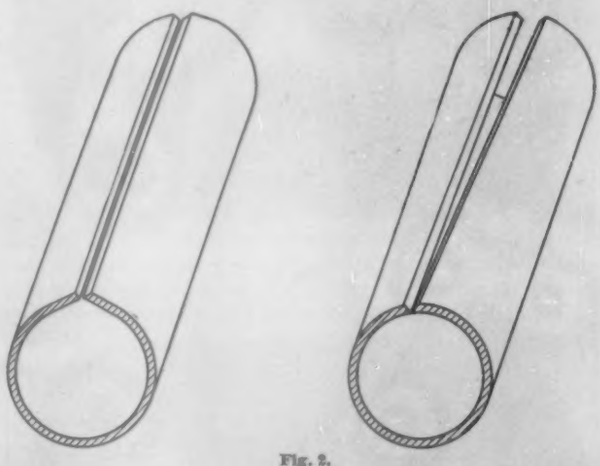


Fig. 2.

*The Vilter Mfg. Co., Milwaukee, Wis.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

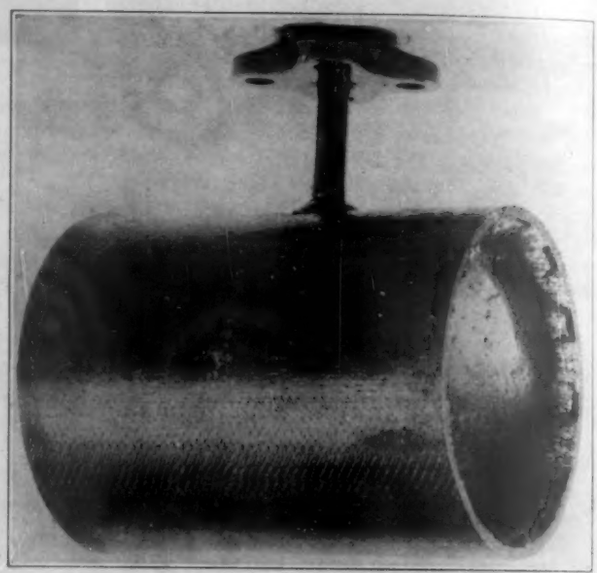


Fig. 8.

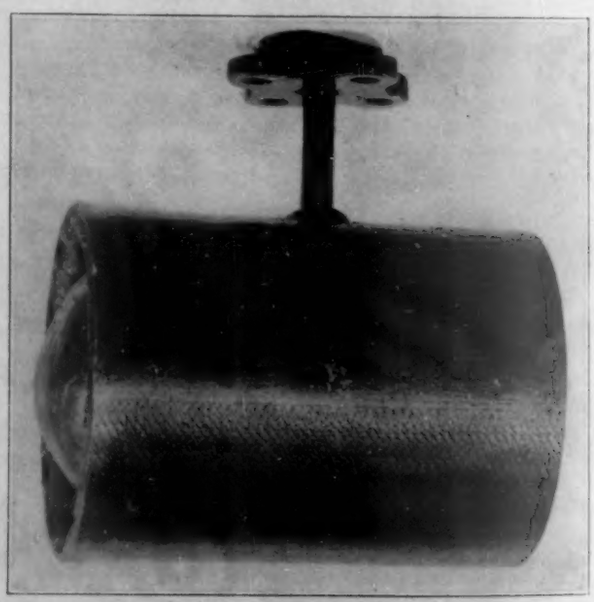


Fig. 9.

to be watched continuously while working. A neutral flame is necessary for steel and iron welding, as an excess of oxygen or acetylene is equally detrimental to the metal. Another point which has to be watched, is that no molten metal from the welding rod is flowing ahead of the melted section of the work, and lays there chilled, and therefore not binding to the sides.

A careful study of these points, convinced me that it is

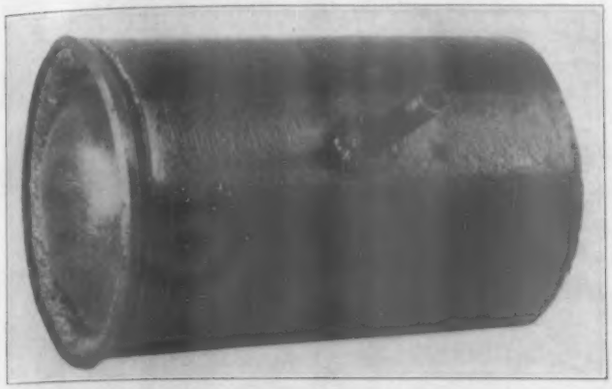


Fig. 10.

easier to teach a man electric arc welding, and get more uniform results day by day, than it is possible in gas welding with the same class of men. As to the preparation and construction of welded work, I wish to say, that this is very important, especially on containers of large quantities of ammonia or gases under pressure.

Pipe headers up to 6-inch diameter, and small work, have a sufficient factor of safety, in the thickness of the walls and added welding material, that it is comparatively easy to

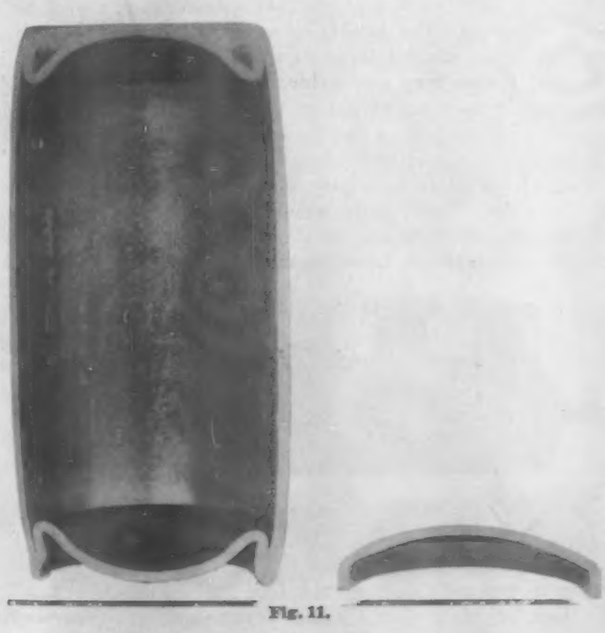


Fig. 11.

get first class results in electric arc or gas welding. Common practice on this class of work, is to drill or burn out the opening holes to receive the nipples and clean the surface around the hole and the end of the nipples from scale and dirt, by grinding or filing. The nipples, if of considerable smaller diameter than the header, may be fitted into holes, tacked on, and when all lined up, welded by gas or electric arc. If the nipples are of nearly the same diameter as the header, they should be fitted to the outside diameter of same so as not to obstruct the interior passage.

In welding longitudinal seams on round tanks, it is first necessary to have a perfect round shell; that is the joining ends of the sheet, shall not have a flattened section as customary when coming from the bending rolls. This flat and peaked looking joint has a tendency of roundening out under pressure, and in so doing, has a wedging action on the weld and is often the cause of rupture. The edges of the seam should be beveled as in all other butt welds.

Before proceeding to weld this seam, we must consider expansion and contraction, which is one of the vital points in welding, and is only too often lost sight of. Starting at one end of the seam, it is necessary to have the edges of the sheet on the opposite end spread apart. My contention for this is, to allow the molten metal which is at its most expanded state, to shrink and gradually bring the edges together as the weld is progressing, and eliminate shrinkage strains as much as possible. For the same reason, I advocate that seam of that kind should be made by one filling

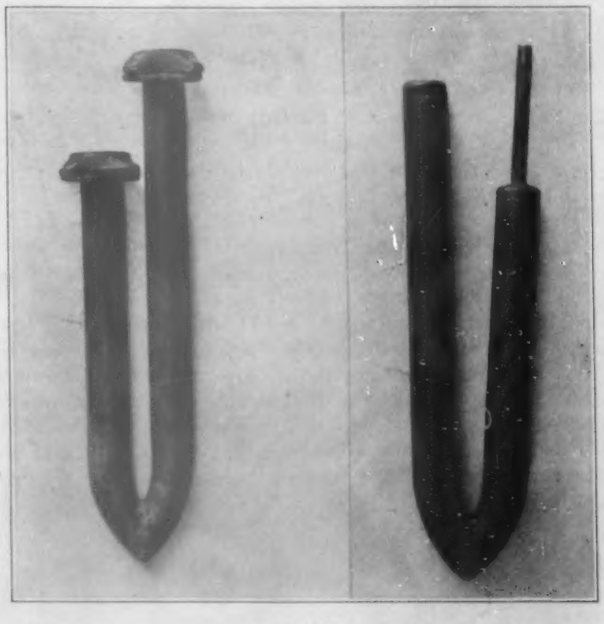


Fig. 12.

in, if possible, or if the sheet is too thick, the heaviest fill should be made while the other end is still open. The proper amount of this opening for acetylene welding should be the thickness of the sheet per foot of length. In other words ¼-inch sheet 6 ft. long should be 6¼ inches or 1½ inches open on the far end. For electric arc welding about one-half of this is enough.

Next comes the question of how to put the heads into a cylindrical shell.

While there are several ways of doing this, there is one way that I would recommend if conditions permit it.

Most people seem to prefer the head put in convex, that is the dishing of the head turned to the outside, because a given thickness of metal will stand more pressure in this shape than put in concave. The effect that this construction has on the weld is very seldom considered, and in my opinion is the most important factor.

In one case, the weld is in tension, and in the other, it is in compression. While everybody will admit that a weld in compression will stand far more than in tension, especially when you are not dead sure how good a weld you have, it is just as easy to figure the thickness of the concave head a little heavier material and be sure of a safe

construction. I will try and illustrate this more plainly.

Fig. 1.—(1) is showing a head put in convex. It is so far pushed into the shell that the weld is in a position where it is subject to a bending strain, which should be avoided as much as possible.

Fig. 1.—(2). shows the same construction, except the line of weld is further down on the flanged part of the head and is in tension only.

Fig. 1.—(3) is a butt welded head of good design with the weld in tension.

Fig. 1.—(4) Has the head put in concave with the weld in compression and by far the better construction inasmuch as the strength of the weld is concerned.

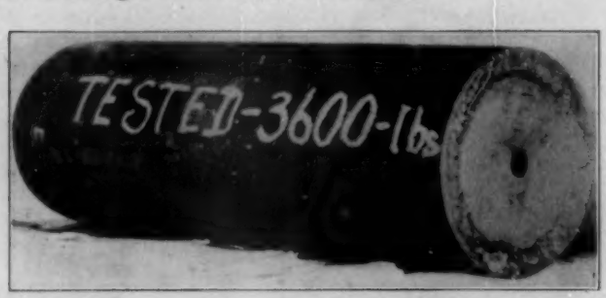


Fig. 13.

Fig. 1.—(5) is also showing a concave head and the end of the cylinder tapered down. This construction as far as depending on the weld is concerned, is the best. It is also most expensive to make, on account of heating the whole end for tapering down. I also want to say that the three styles with the weld in tension should be annealed after welding to relieve the strains, while with those having concave heads and the weld in compression, it is not necessary.

Fig. 2.—This is showing the shell construction, and refers to the peaked joint, and to the opening of the opposite end when starting to weld. In this connection I want to mention that we do not use nor advocate the use of rolled shells with longitudinal welded seams for ammonia receivers, but take lap-welded steel pipe and weld concave heads only.

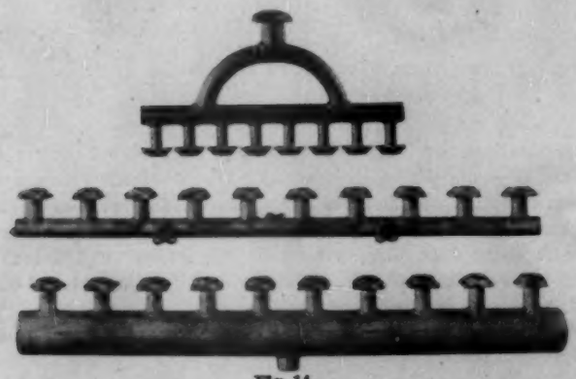


Fig. 14.

Fig. 3.—I will now show several test pieces which have been made to show the strength of welds. This is showing a 20-inch diameter 7/16-inch thick flange steel shell, with 2 9/16-inch thick flanged and dished heads.

Fig. 4.—One head welded convex.

Fig. 5.—The other concave. This was welded with oxy-acetylene about 7 years ago, and one of the first tests made.

Fig. 6.—It had been put to hydraulic pressure of 1200 lbs. per square inch at which pressure the concave head started to bulge out as can be noticed on the picture. The strain on the longitudinal welded seam at this test pressure is 28,080 lbs. per square inch stress in metal.

Fig. 7.—Here is shown a piece of 6-inch lapwelded pipe of common thickness, both heads welded in convex by the electric arc process. A 1-inch nipple also welded in to receive hydraulic pressure. After raising the pressure to 3300 lbs. per square inch, the pipe opened up in the lapwelded seam for almost the entire length, excepting 1 inch from one end, and 2½ inches from the other, indicating that the weld around the heads, held the pipe from ripping way across. In welding these heads as well as all the following described work, there was no special care taken to make an extra good job for testing purposes only. Lapwelded pipe as made by all pipe mills, is almost universally accepted as safe a construction as possible, while electric or gas welding is looked upon with suspicion. This is by no means the only sample where the pipe bursted and the welds held.

Fig. 15.

Fig. 8.—Here is shown an 8-inch common pipe with both heads of 5/16-inch thickness welded in concave. At a pressure of 2600 lbs. one head started to turn outwardly or reverse the dishing. At this time the pressure dropped down to 1600 lbs. which was sufficient to completely turn the head to the outside.

Fig. 9.—In welding this tank we wanted to produce an extremely poor weld, and for that reason made a very light weld all around the heads, so as to hold water, and then just welded a second layer in spots 1 inch long, leaving a space of 1 inch long not welded between spots. This weld, however, is as intact as before the test, all though it had to stretch with the pipe as can be seen by the enlarged diameter of the pipe end, and is still good to be tested higher.

Fig. 10.—This tank is also made of 8-inch common pipe with 5/16-inch thick heads, welded concave. It was made up for special demonstrating purposes and was welded with the electric arc, just one layer of welding material, in the presence of Mr. Thomas Andersen, Inspector, Department of Steam Boiler and Cooling Plants, of the city of Chicago, and Mr. Gearon, also of the same department, also the Chief Boiler Inspector of the State of Wisconsin, Mr. Edgar, and the Milwaukee Inspector of the Hartford Steam Boiler Inspection and Insurance Co., Mr. Bowie. This tank had been subjected to hydraulic pressure and at 3600 lbs. one head started to reverse its dishing to the outside. After it had a start the pressure dropped to 1400 lbs. which was sufficient to turn the head to a ball shape as can be seen in the picture. Arriving at that shape the pressure went up again to 2500 lbs. when the end of the pipe started to expand in

Fig. 16.

diameter, due to the tendency of the flanging of the head to straighten out. After the pipe end expanded ½-inch in diameter, the pressure dropped to 2000 lbs. at which pressure the pipe tore off at the point where the distortion of the pipe started. The weld itself is showing absolutely no sign of being affected.

Fig. 11.—This picture is also showing an 8-inch common pipe with both heads welded concave. The ends of the pipe

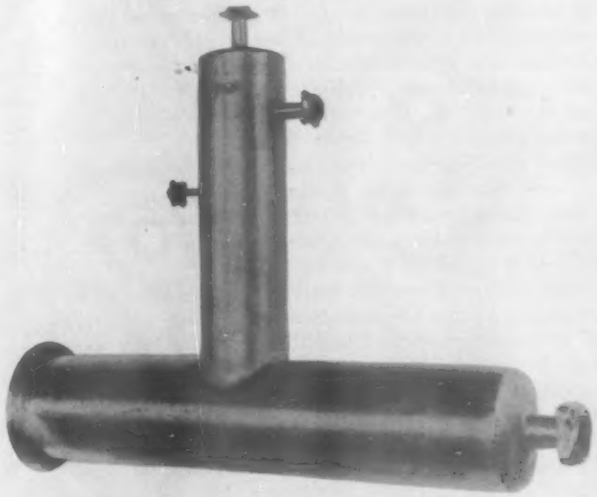


Fig. 17.

had been tapered down to about ¾-inch smaller than its former diameter. The original shape of the heads before pressure was applied, is shown laying alongside. This tank has been closely watched while under pressure, and it was noted that at 2200 lbs. one head started to bulge outwardly. At 2400 lbs. the other head started and kept on going until both completely turned to the outside. Keeping the pressure going higher, we noticed that at 3200 lbs. the pipe shell started to expand on diameter until we reached a pressure of 3700 lbs. at which time the nipple, welded in to receive the pressure, started to leak at the welded base, and our pump could not supply it. This leak, however, was not due to a poor weld but a direct cause of the expanding of the

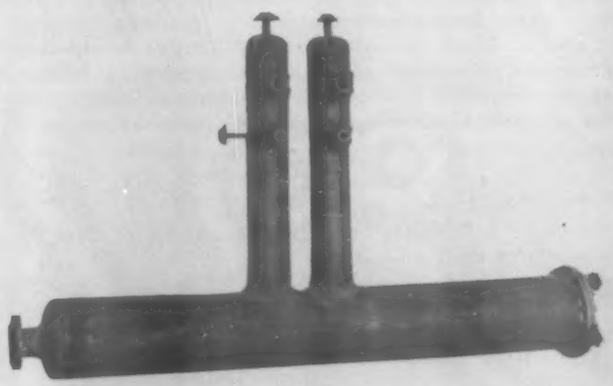


Fig. 18.

shell, which we found to be about ⅛ inch larger in diameter. Aside from this leak every other part of the welding was perfectly tight to the last.

Fig. 12.—Is showing a special constructed return bend made of 2-inch common pipe. The junction of the two pipes is welded with oxy-acetylene. The drop forged couplings are screwed on, and were closed with blank flanges by four ⅝-inch bolts in each flange. After putting pressure on this we found that at 3000 lbs. pressure the bolts holding the blank flanges stretched and we could not hold the gaskets tight. The couplings were then taken off and the ends of the pipes welded shut. At 6200 lbs. the diameter of the pipes started to expand at certain places and at 7000 lbs. a very small bulge occurred on one pipe and split for about ⅛ inch in length. By this time the pipes expanded at some places 1/16 inch in diameter and the two pipe legs spread

Fig. 19.

from a parallel position to the one shown in the lower picture which is 1⅛ inches more, on a length of 2 ft. than it formerly was. The weld itself is still intact.

Fig. 13.—Here is shown a seamless drawn tank 8 inches in diameter with one end solid closed. The shell is 5/16-inch thick, one flat head 1⅛-inch thick welded electrically. The test as indicated on picture was 3600 lbs. Several of these tanks had been made for the Federal Pressed Steel Tank Co. and were tested by the American Ox-Hydric Co. and had to comply with the specifications of the Interstate Commission for the transportation of explosives.

Fig. 14.—This is showing application of welding to actual work which could not be made any other way but welding. The top header is 2½-inch pipe with 1-inch nipples, 5-inch center distance. The close spacing of nipples would not permit fittings to be used. The two lower headers are made

Fig. 20.

of 2½-inch and 6-inch black pipe, and after welding have been galvanized, which also could not be done if made up by screwed fittings.

Fig. 15.—A welded steam receiver 24 inches in diameter, ⅜-inch welded shell, 6 ft. long, ½-inch thick head and one 6-inch and one 8-inch nipple. Steel flange welded on to bolt on head.

Fig. 16.—A suction drum for two compressors to equalize

suction pressure. Made of 24-inch pipe ½-inch wall, 8 ft. long with four 10-inch nipples and one 8-inch nipple.

Fig. 17.—A welded accumulator 16-inch pipe with 12-inch tee piece.

Fig. 18.—Another accumulator 16-inch pipe with two 8-inch legs.

Fig. 19.—This is showing an electric resistance weld the smoothness on the outside, and also showing the clear passage thru the pipe.

Fig. 20.—Showing the north end of our welding and pipe shop. Ice tank coils to right, a lot of welded headers to

Fig. 21.

the left, and 8-inch pipe bend in the center, condenser coils to the left rear. The machinery can not be seen way in the background.

Fig. 21.—The south end of the same shop. Expansion piping in the foreground, welding department to left. Transfer crane in the center.

One more thing I want to mention and that is the way of testing. On all our ammonia work we put an hydraulic strain test of 600 lbs. and right after, an air test of 250 lbs. under water to find any possible leak. We do not allow any caulking of leaks but every pinhole must be welded tight.

BY-LAWS
for the
AMERICAN ACETYLENE WELDERS ASSOCIATION

ARTICLE I
NAME

The name of the Organization shall be the American Acetylene Welders Association.

ARTICLE II
OBJECT

The object of this organization shall be the advancement of the welding trade in all its lines and branches, and especially the education of its members and to secure the manufacture of safer and more advanced welding and the securing of the most favorable attitude possible on the part of the general public towards the welding trade.

ARTICLE III
OFFICERS

Section 1. The officers of this Organization shall be a President, two Vice-Presidents, a Recording Secretary, a Corresponding Secretary, a Treasurer and a Board of three Trustees.

Sec. 2. It shall be the duty of the President to preside at all the meetings of the Organization, to enforce due observance of the By-Laws, to appoint all Committees not otherwise provided for, and to see that the officers perform their respective duties. The President shall not vote except in case of a tie, and shall then give the casting vote.

Sec. 3. It shall be the duty of the Vice-Presidents, in the order of their election, to perform all the duties of the President in his absence, or when requested by the President to do so.

Sec. 4. The Recording Secretary shall keep the minutes of all the meetings of the Organization, a record of attendance and a statement of the name, residence and time of admission of each member. He shall read the minutes at each regular meeting, prepare a report for the annual meeting, and perform such other duties, pertaining to his office, as the President may direct.

Sec. 5. The Corresponding Secretary shall send notices to each member of all meetings and entertainments of the Organization; notify officers and new members of their election; conduct the general correspondence of the Organization, and report at the annual meeting.

Sec. 6. The Treasurer shall be the custodian of all moneys belonging to the Organization; shall keep a correct account of all moneys received and disbursed by him; shall receive and file vouchers for all disbursements; shall be ready to report at any meeting the balance in the treasury, and shall prepare a full statement to be read at the annual meeting of the Organization. No disbursements shall be made by the Treasurer, unless authorized by the Board of Trustees.

Sec. 7. All elections of officers shall be by ballot.

Sec. 8. All officers shall be elected for one year.

Sec. 9. The newly elected officers shall enter upon their duties at the first meeting succeeding their election.

ARTICLE IV
BOARD OF TRUSTEES

Sec. 1. Special meetings of the Board may be called by the Chairman at any time, or upon the written request of two members of the Board, or ten members of the Organization.

Sec. 2. The proceedings of the Board shall be entirely confidential, and any member violating this regulation shall be expelled from the Board as unworthy of the confidence of the Organization.

Sec. 3. All business transacted by the Board shall be reported at the regular business meetings of the Organization, and the Chairman of the Board shall prepare a report to be read at the annual meeting.

Sec. 4. Upon the failure of any Trustee to attend four consecutive meetings of the Board, without a reasonable excuse, his office shall be declared vacant, and thereupon his successor shall be chosen by the Organization.

ARTICLE V
COMMITTEES

The Committees shall be as follows:

Sec. 1. A Program Committee, consisting of three members, which shall present a program for the meetings of the ensuing year, at the annual meeting.

Sec. 2. A Membership Committee, to whom all applications for membership shall be submitted. It shall investigate the qualifications of such applicants and report to the Executive Committee for action.

Sec. 3. An Auditing Committee, which shall examine the accounts of the Treasurer, and report at the annual meeting.

Sec. 4. A Ways and Means Committee, to devise and direct the plans for raising money for carrying on the work of the Organization.

Sec. 5. A Nomination Committee, consisting of five members, shall be appointed by the Executive Committee, at the last meeting, and shall present to the Organization, at the annual meeting, a list of candidates, two names for each office.

The Officers shall be voted for separately.

ARTICLE VI
MEMBERSHIP AND DUES

Sec. 1. The name and address of any candidate for admission to the Organization, with his qualifications for membership, must be presented to the Board of Trustees, in writing, by a member of the Organization.

Sec. 2. The name shall be received and acted on at the next meeting of the Board, and, if accepted, shall be announced to the Organization by sending the name to each member with the notice for the next regular meeting.

Sec. 3. If any member of the Organization know any good reason why a proposed candidate should not be admitted to membership, it shall be his duty, under the seal of confidence, to acquaint the Board of Trustees with the facts, and the Board, after due examination, shall take such measures as they shall consider best for the withdrawal of such candidate's name.

Sec. 4. If no valid objection be made, the name shall be balloted on by the Organization at its next business meeting.

Sec. 5. Any one duly elected may become a member of this Organization by the payment of the annual dues, payable on election.

Sec. 6. The annual dues shall be three dollars, and shall be payable at or before the annual meeting.

ARTICLE VII
AMENDMENTS

These By-Laws may be amended by a two-thirds vote of the members present at any business meeting, provided that the proposed amendment has been submitted in writing at a previous business meeting, and that notice of the intention to amend has been appended to the call for the meeting at which the amendment is to be acted upon.

BY-LAWS

No. 1. The annual election of officers shall take place at the meeting in March, at which meeting all reports of officers and Standing Committees shall be presented. Members only shall be present at business meetings.

No 2. A special meeting may be called at any time by the President, or upon the written request of ten members of the Organization.

No. 3. The regular monthly meetings of the Organization shall be held on the first Wednesday of every month.

No. 4. Fifteen members shall constitute a quorum at any meeting of the Organization.

No. 5. Any officer expecting to be absent from one or more meetings shall send a notice to the President, and his duties shall be performed by a member designated by the President.

No. 6. A member wishing to sever his connection with the Organization must send a written resignation to the Board of Trustees, who shall accept the same and report it to the Secretaries and Treasurer, and to the Organization at its next business meeting.

No. 7. The President is authorized to fill a vacancy in any office occasioned by resignation or absence until the time of holding the next business meeting, when such vacancy be filled by the Organization.

No. 8. It shall be the duty of the Nominating Committee to prepare a list of candidates for the several officers to be presented at the annual meeting.

No. 9. The Manual of the Organization and a ticket of membership shall be forwarded to each new member.

No. 10. The accounts of the Treasurer shall be examined annually by the Auditors appointed by the Officers.

No. 11. These By-Laws may be amended or added to by a two-thirds vote of the members present at any business meeting of the Organization, provided that notice of the amendment has been given at the preceding meeting.

No. 12. The rules contained in "Branch's Parliamentary Procedure" shall govern the Organization in all cases in which they are applicable, provided they are not inconsistent with the By-Laws of the Organization.

ORDER OF EXERCISES FOR REGULAR MEETINGS

1. Call to order.
2. Roll Call.
3. Reading the minutes.
4. Programme.
5. Discussion.
6. Communications and any necessary business.
7. Reports of Special Committees.
8. Report of Treasurer.
9. Report of Chairman of Board of Trustees.
10. Reports of Standing Committees.
11. Adjournment.

ORDER OF EXERCISES FOR ANNUAL MEETING

1. Call to order.
2. Roll call.
3. Reading of minutes.
4. Report of Nominating Committee.
5. Appointment of Tellers.
6. Distribution of ballots.
7. Collection of ballots.
8. Report of President.
9. Report of Chairman of Board of Trustees.
10. Report of Recording Secretary.
11. Report of Corresponding Secretary.
12. Report of Treasurer.
13. Reports of Chairman of Standing Committees.
14. Report of Chairman of Advisory Committee.
15. Report of Tellers.
16. Unfinished business.
17. Election of new members.
18. Adjournment.

AUTOGENOUS AND ELECTRIC WELDING.

The introduction of autogenous and electric welding processes in railway repair shops is undoubtedly the greatest single advance which has been made in railway shop practice in recent years. Not a few roads suffered severe disappointment in the early stages of the development of these welding and cutting processes because of a lack of knowledge of the limitations of the various systems and as to the fundamental principles underlying their use. Gradually, however, the difficulties have been overcome, one by one. The competition between the autogenous and electric systems was rather strong at one time and unreasonable claims were made in the interests of each system. As the advantages and limitations of each became better known, however, it was recognized that both could be used to advantage in the same shop, each on the classes of work for which it was best suited.

A typical expression of opinion as to the advantages of the autogenous and electric welding systems in railway shops follows; it is taken from a letter of a motive power officer: "By far the greatest help that has been given to railroad shops, in my opinion, has been the introduction of electric welding and oxy-acetylene welding and cutting. For instance, at ——— we now have five men constantly employed repairing broken or worn parts, many of which would formerly have been sent to the scrap and others repaired by other methods at much higher cost. The practice of welding locomotive tubes to the back flue sheet has practically eliminated the delays and failures to engines on the road due to leaking tubes, and has enabled us to retain a set of tubes in a boiler in heavy service for the maximum period allowed by law—three years—where formerly they would not last more than 18 months because of the frequency of work performed on the firebox end of the tubes. This also results in longer life of tube sheets, many of which were formerly removed because of cracking at the upper flange, due to elongation caused by frequent prossering of tubes.—*Railway Mechanical Engineer.*

The Welding Engineer

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VOLUME 2. JULY, 1917. NUMBER 7.

Building A Business.

MANY people have the idea that the invention is the important thing. Very few engineering businesses, however, are founded altogether on exclusive and basic patents. They are based rather on a combination of scientific knowledge and business sagacity, with the help of such protection, monopoly or trading advantages as can be obtained from the detail patents which it may be possible to secure as the development of the art unfolds itself. A man may have the germ of a good idea for a successful business, but still nothing that can be protected by a patent, even though patentable improvements will doubtless be discovered upon developing the idea. Nevertheless, the essential factor is the broad judgment or foresight which leads him to take up certain matters at a particular juncture, and not the specific mechanical contrivances by which he may carry out his ideas. In such cases, the best protection to the idea is advertising by means of which he can promptly get the full benefit of the potential demand for his product before competitors have had time to imitate and develop. Once he has his organization and business well under way, competition will be at a disadvantage.

The Economy of a Huge Airplane Squadron.

THE experience of our allies, particularly on the western front, where the final decision seems likely to be obtained, points conclusively to the great importance of aircraft as the deciding factor in all the great battles of the war. There is very little open fighting in the present war, contrary to the methods pursued in former wars. Men are hidden in trenches, and they are armed with rifles, machine guns, smoke bombs and other missiles, to prevent their capture by the enemy. Open attack means death to practically every man.

The artillerymen on each side are in hiding far behind the first line of trenches, and they endeavor to blow enemy trenches to pieces by subjecting them to a rain of tons of high explosive shells. Then an attack is launched, and, if the preparation has been complete, the trench is captured. To make such a bombardment successful, the gunner must know exactly where to shoot, and he must be kept informed how his shots are being placed. This can only be done from the air. High above, nearly three miles according to the present practice, the spotting airplane, upon which the gunner depends for his information, patrols the air and sends wireless messages. These give the location of the enemy's guns and also direct the demolition of the trenches. With this information, the gunners can train their enormous guns and work deadly havoc eight or ten miles away and never see the target at which they are shooting. Without the spotter in the air the gunner is comparatively helpless, the observation balloon playing a part of diminishing importance in the present struggle.

But the spotter does not have things all his own way if the enemy has a fleet of fighting airplanes, whose duty it is to drive down the spotter and prevent him from sending information to his gunners. This makes it clear that the army whose fliers can dominate the air, who can observe the enemy and direct the gunfire of their own batteries and at the same time prevent the enemy fliers from serving their own army in the same way, can pound its adversary to pieces and drive it from place to place. The destruction of trenches and fortifications can be accomplished so thoroughly by artillery that resistance becomes hopeless, the men become disheartened, and their positions can be carried by the attackers with the loss of very few men.

Government Regulation of Prices.

PREDICTIONS are becoming more and more common that it will become necessary for the Government to regulate prices in the steel industry. The proposal is glibly made, but it involves serious and far-reaching consequences. It is important to note that the suggestion refers to prices in the steel industry, not simply to prices of the steel industry, as the latter would refer only to prices steel manufacturers would charge those who lie beyond the industry proper, while the former includes also the inter-department prices, inside the industry.

It is not so long ago that the fear pervaded many quarters that if the Government purchased steel for war use at much below the market, the market would eventually recede to the level fixed on the Government portion. It was a case of fearing rather than expecting, because with advancing costs the prices might not produce profits commensurate with war time taxation and national borrowing operations.

Conventions Are Necessary.

PRESIDENT LINCOLN used to tell a story of his boy Tad. "What," asked Lincoln of a crowd, "what shall we do with the confederates." "Hang 'em," cried someone in the crowd. "No," said Tad, "hang on to 'em."

The tendency in regard to business conventions in war times is to discontinue them but *The Welding Engineer* echoes most heartily the cry "Hang on to 'em." Never was the need of business co-operation and united judgment needed as it is at present.

A right-minded, forward-looking man does not wait for compulsory legislation to develop his business organization to the highest degree of efficiency. This type of man, for years, has developed not only the administrative and technical divisions of his plant, but when most successful, has given a great deal of thought to the human equation—the giving of happiness and meting out justice to his employees. To him it was apparent that by intensively studying the health of his workers he was establishing some splendid new points of contact between himself and his men and in so doing narrowed the gulf that has always existed between capital and labor.

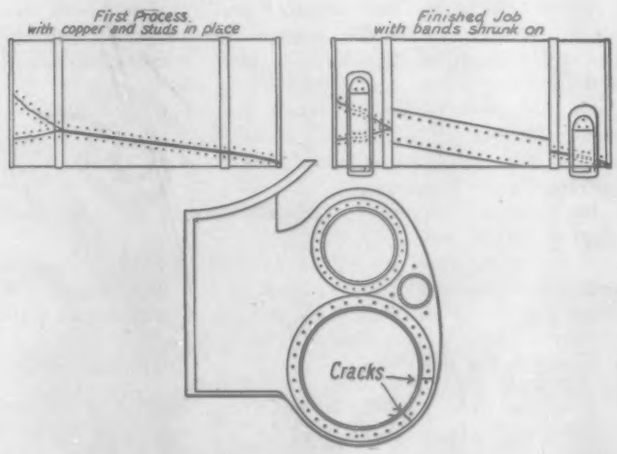
Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way—I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today—the men on the firing line are waiting.

L. B. Mackenzie, Editor.

ARC WELDING LOCOMOTIVE CYLINDERS.

Editor: I think it is generally conceded that for welds on cast iron the oxy-acetylene process is the best, and where there is any pressure of air, water, or steam, the only dependable weld. But occasions arise in power houses, and especially in round houses, where it is not always possible to get at the fracture conveniently, or to preheat same. which must be done in the oxy-acetylene process, in which case it happens that the electric arc process can be used with good results and engines kept at work on the road, which otherwise would have to be sent to the shop and there remain for weeks, if not months, sometimes during a rush period when they are badly needed to haul congested freight.



I will describe here how we kept two engines on the road which would otherwise have had to be taken to the shop for new cylinders.

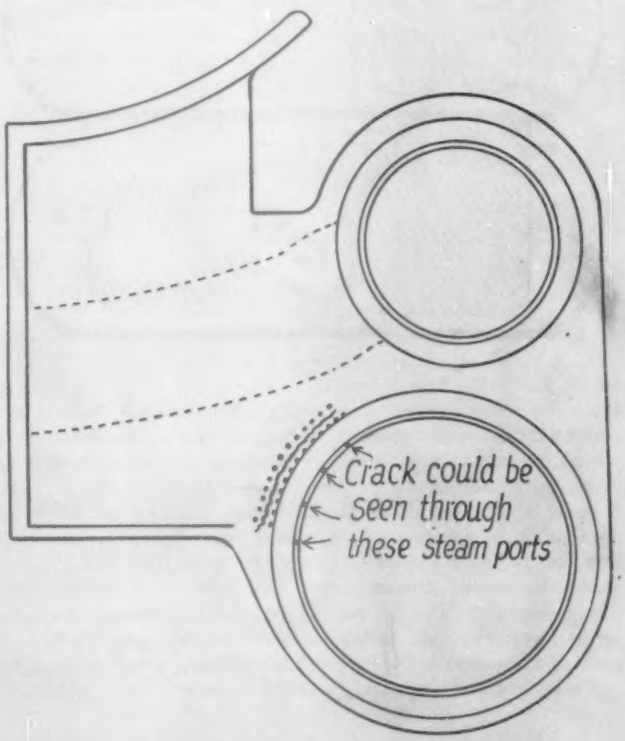
In the first case the cylinder was cracked the whole length, as shown, and was bored out and a bushing inserted, but of course, the steam made its way to the *crack* through the port holes cut in bushing for admission of steam.

A channel was cut along the path of the crack about 3/8-inch broad and after slightly dovetailing same, copper rod was tightly corked into channel, 3/8-inch copper rod being used. Three-fourths-inch sticks were then put along channel, 2¼ inches apart, after which the whole received an electric weld, coating right over the copper and sticks about ½ inch thick.

Next a ¾-inch patch of boiler plate was developed to suit contour of cylinder between cylinder ribs and fixed to cylinder wall by 7/8-inch or countersunk head screws, after which heads of screws all around patch were welded. These screws were not allowed to go through cylinder wall.

Four pieces of 1¼-inch steel were next applied to cylinder ends where patch could not be put. Heads of attaching screws were then welded over and all around these pieces, after which the blacksmith shrunk on two 1¼-inch bands, stitched over these pieces and, with a little touching up, there was an entire absence of any leakage of steam.

The above engine was one of our largest freight engines and was kept on the road (C. R. I. & P.), by above means for over a year.



The other job, though a much smaller job, was just as important and was done some time ago on a large passenger engine.

The engine developed a crack between the cylinder valve and cylinder proper and could be plainly seen on looking up the ports in the valve cylinder, and was where it could not be patched in any manner.

The very same procedure was followed as in the first case,

a channel being cut, dovetailed, and copper corked tightly, sticks applied on each side of crack, and the whole being electric welded over and no patch at all applied. This seemed to make a good job.

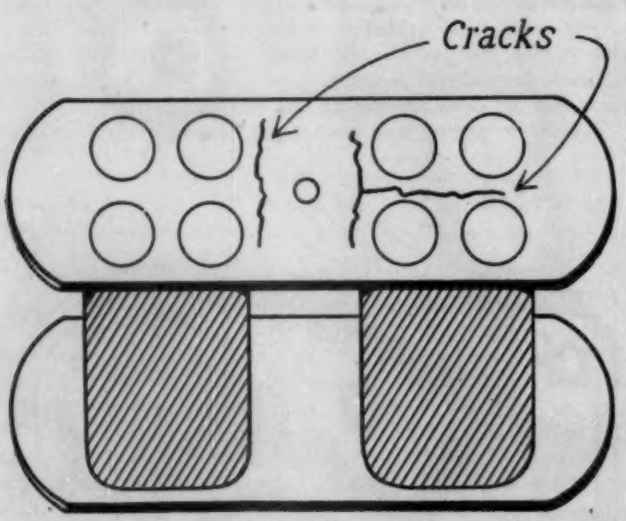
I may add that ordinary Norway iron was used with no flux of any kind. This seems to mix well and stick to the copper. Of course it welds well to the sticks also and on cooling tends to contract and pulls the crack close, naturally tending to hold the tightly corked copper in place.

Railroad Welder.

DOUBLE CYLINDER.

Editor: I wish to tell you about a little job that I did about a year ago. It was a casting from the U. S. S. Cruiser Milwaukee, a double cylinder from their dispatch boat being 8-inch bore, which had the inside head cracked on each head. Bear in mind that the job had been attempted in a job welding place, without success.

I cut most of the top jacket off and then beveled out the inside crack, where it had been welded before, then made a charcoal fire under and around, plus a crude oil torch on top, until it was at the proper heat. I then handed the oil torch to my helper and had him move it around continuously



to keep it hot while I welded head. I did not have time to test when the operation was that far, because the cruiser was waiting for the cylinder to be welded, so I completed it all in one operation, welding back on the water jacket in place, while we made the best of it with the heating torch. Now this was done out in the open, because we have no preheating arrangements at this place, but when the job was completed I placed considerable sheet iron and a hood, plus some more charcoal on it and Monday morning when it was tested out the job was as good as I could expect, there being only two pin holes in the outside jacket where I crossed the weld made at a previous welding, which I stopped, and then it stood 60 pounds water pressure. Bert Baldus.

HOME-MADE CUTTING ATTACHMENT

Editor: If you care to pass this on, I am sure it will help some workman out of the same hole in which I found myself a few days ago. I had to cut up a boiler plate to make an out side casing for an oil furnace, and not having a cutting torch on hand, this is the way I went about it. I took two pieces of small ⅛ pipe and welded them together in a T shape, after having put a hole in the middle of the pipe before welding. I then cut the oxygen hose in two. Then I inserted my T in the oxygen hose and connected another hose to the nipple which I had welded in and to the other end of this hose I attached my decarbonizing torch and wired the end of the copper tubing on the decarbonizing torch to the lower side of the welding torch tip.

P. A. Bailey.

Answer: As a general rule we would advise welders to purchase apparatus rather than to attempt its manufacture. In your particular case you had an emergency job and got away with it by using the device you outlined. You must have, however, used a whole lot more oxygen than you should have and in these days of concentric cutting torches or cutting attachments it is rather uneconomical to use the old-fashioned side attachment which you devised from your decarbonizing torch.

If you have any cutting to do to any commercial extent we would strongly advise that you purchase a modern cutting torch or cutting attachment.—Editor.

Editor: We have noted the article in your June issue wherein you refer to the "process for cleaning non-skid tire molds and mechanical rubber molds by the aid of the Oxy-Acetylene welding torch" as a "new" and "recent" development of the process.

We were not aware of the fact that our American cousins were so far behind the times in this connection. This valuable application was, to our knowledge, first introduced in Canada by one of our operators some *two years ago*. It was quickly adopted and has since been used by all the leading manufacturers in the industry on this side—which all goes to prove your point of the value in passing on one's experiences.

E. J. Houghton, Toronto Branch L'Air Liquide Society.

ARC WELDING ENGINE FRAMES.

Editor: I have read several articles on welding frames, but all have been different from the one we use on the Erie.

We use the carbon electrode to V out frame and finish with an air hammer to 90 deg. angle. The machinists then cut triangular pieces of ½-inch boiler plate, beveling on both R and L sides. These plates fit flush in the V. Fit the first plate flush with bottom of frame and weld in bevel, using metal electrode. Then chip the weld flush with top of plate so that the next plate will lay perfectly flat. Continue this operation until V is closed.

This method has proved very satisfactory and also saves a great deal of time.

We have also had success in welding high speed steel to wrought iron shanks. Bevel both as per illustration. Use metal electrode. Then chip the weld flush with top of plate to keep tool from warping.

By holding a short arc and using low voltage this method will prove a success. Sherman Dunfee.

CAST IRON WHEEL DIFFICULTIES.

Editor: I am a reader of your magazine and in the past have received information which has made me successful in welding some jobs where without it I would have failed. I am enclosing a sketch of a cast iron wheel and would like to know how to preheat this job so as to carry out the weld successfully. Outside diameter of wheel 24 inches, rim is 1½ by 3¼ inches. C. S. Thomas.

Answer: If you can get a new flywheel easily we would advise its purchase rather than repair this one. There is no particular difficulty about welding it successfully, except that the cost is prohibitive if a new one is easily procurable.

In a wheel of this comparatively small diameter we should build a charcoal fire for the entire wheel, giving the hub the largest part of the heat. Weld the two breaks on the hub and allow the hub to cool down first. Then weld the break in the spoke while the rim is still expanded, taking off the fire on the rim when the weld in the spoke is completed. Editor.

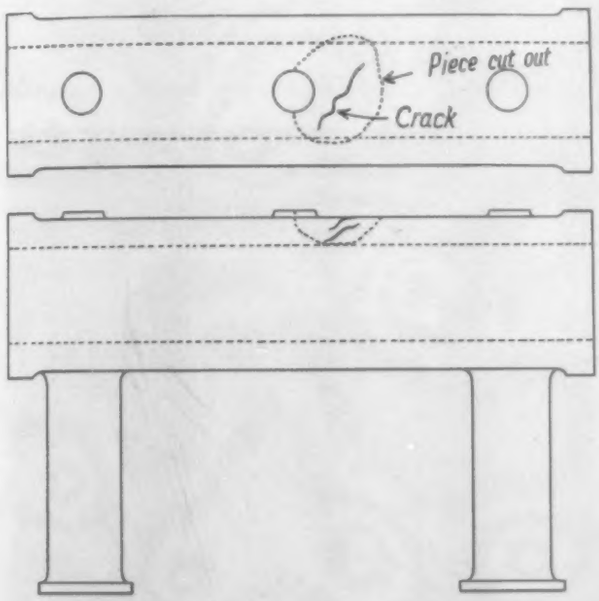
USED R. R. TIES TO PREHEAT.

Editor: One morning in February I was called over to a power company to look at a small job (as they called it). On my arrival I found it a much larger job than they thought it was, for the simple reason they thought all I had to do was to pour the metal in the crack and let it go at that.

The pump was leaking from a crack on the inside jacket about 6 inches in length which, as most welders know, is not a very easy job to get at. The foreman thought it could be done right on its foundation, but after looking it over I had them take it out in the yard. After telling the foreman that I had to preheat the whole casting, or the weld could not hold, he agreed that I was right and had it taken out in the yard.

The dimensions, as I remember them, were about as follows: Weight of casting 1,000 pounds, length 6 feet, outside diameter 16 inches, inside jacket 14 inches, bore 10 inches, the legs being cast with the pump, which made a height of 4 feet.

A rough sketch of the casting will show you what I was up against.



I could not get at the break through the water hole in the top as it was too small, nor could I get at it from the inside on account of a shoulder in the center of the bore, so I cut out part of the outside jacket (see dotted lines on sketch), to get at the breaks, making it really two water tight welds I had on hand instead of one. Now I was ready to preheat, but the heating proposition loomed up, but thanks to a railroad company near by, I borrowed some railroad ties and built a fire around the casting. I believe I used up two dozen ties plus some small wood to start with. Having it properly heated I began to weld and found that instead of a 6-inch crack I had to dig out 2 inches on each end, and one inch on each side, to get the sand out of the casting. Having that done I closed up the hole and then put the part I had cut out back in position and welded that also, which finished the welding operation.

I meant to state that it was snowing all this time, about five hours.

Now how to keep it from cracking when cooling was one more thing I had to contend with. I got half a dozen barrels of sawdust, and by covering the casting with it, I let it smolder until all burnt out, having covered it over with asbestos which, after testing the pump, proved to be just what was needed.

In twenty-four hours the pump was doing business at the old stand again. H. L. Ducheson.

WELDING AMMONIA PIPES.

Editor: We have a partial failure in a job of brazing on an old ammonia coil and write for any data you may have on this kind of work.

If any of your recent issues treat on this subject in a way that will help us in our case will you kindly mail us the copy and we will forward stamps to cover.

This coil in question has been in use for ten years. Its construction is the best of steel pipe, screwed and sweat in to cast steel return bends with soft solder. The joints were leaking ammonia and we attempted to braze them with Tobin Bronze. Can this be done successful? Will brazing hold ammonia? There are about twenty joints to a coil and possibly half of them are holding so far.

What would you advise? Our talents are exhausted and will appreciate your favor by return mail as we must have this coil in operation immediately.

Answer: The reason the joints were screwed in and sweated in the first place is because a brazing job is always unsatisfactory. Ammonia has a peculiar affinity for brass and will destroy it in a short time. We recommend that you weld these joints. Heat the joint with torch and brush out old solder, brass, etc., with a stiff wire brush. Use Norway iron filler rod. Editor.

CUTTING A CHANNEL.

Editor: A piece of work came to my notice recently in the shop where I am employed which I thought might be of value to other cutters. The problem is this: A piece of channel iron marked on the outside of the flange, "To be

cut off." "The web of the channel to be left intact." The main question is to take all flange off, but leave all of the web.

The shaded portion shows part to be cut. I tried to cut this with an ordinary tip from the outside of the channel but it is extremely hard to do, so I closed a No. 2 rivet tip and cut on the inside of the flange. I have made several hundred of these cuts and must say it works fine.

Earl S. Lee.

The Cunard Steamship Co., according to reports of a conference of shipbuilders in Philadelphia, has plans to place orders for 114 ships in this country. The ships would range in size from 8,000 to 17,000 tons, it is said, and cost $120,000,000. In some quarters it is believed that the completion of negotiations will depend on the outcome of amendents to the shipping board act. It is interesting to note that the shipbuilders are planning an organization to get more men into the industry.

Applying Rubber Gaskets.—In placing rubber packing for joints it should be coated with either graphite or chalk to prevent adhering to the metal when the joint is to be broken. —Power.

Before the days of agricultural colleges the old time farmer put in twenty years of his life learning what his boy can now learn at college in a couple of short courses. This may also be said to be true of old time welders.

THE WELDERS ASSOCIATION.

I am very much pleased to note the vast interest our welders are taking in our newly organized association, and the number attending tonight's meeting is really more than I had expected. However, let us hope that these meetings will continue regularly with the purpose of developing the Oxy-Acetylene welding and cutting industry to such an extent that our daily toil will be considered by the public and manufacturers as a reliable profession.

Gentlemen, when I say that we shall be considered by all as a profession, it is because many industries and engineering societies are criticising our profession as unreliable, and this is due to accidents and failures that occur daily. These critics are not decreasing, and it seems to me, that with our present system we are not showing any improvements or decreasing these accidents and failures.

Now let us see. Are there accidents and failures inevitable to our trade? Is our profession really os dangerous and unreliable? No, gentlemen, our trade is not so secure from dangers and reliability but is also a noble trade, that is not only saving the Nation's money, but also a life saver. Our daily toil is to reclaim broken castings, and thus allowing the Nation's foundries and steel mills to produce other articles so badly needed at the present time. We are saving many a plant from a standstill by welding promptly a defected casting. We are in fact keeping the wheels of our industries and railroads going without interruption. We are also decreasing the cost of production. We are also decreasing the cost of production on many articles with the aid of the Oxy-Acetylene blowpipe. We have relieved, to a great extent, the constant pressure on the boiler shop men, and today a couple of competent welders will do more fire box work than a dozen boilermakers. Some railroads have decreased the heavy sledging and hammering, that cost many a human eye, and instead have replaced the safe Oxy-Acetylene blowpipe, where rivets and bolts are cut out safer, quicker, and better.

Our modern Fire Department in large cities have saved many a human life from being destroyed by fire or water with the aid of the Oxy-Acetylene cutter, and yet you will find intelligent men condemning our profession.

Gentlemen, we are the Nation's reclaiming engineers, and our association has got to prove this to all concerned. Do not feel secure because you are at the present time making good wages. There is at present under consideration among our legislators the advisability of limiting our welding operations. If such drastic laws should be passed against gas welding in our State, then the rich and successful welders will be hit just as hard as the poor and unsuccessful welder. Therefore it is absolutely necessary to educate, help, and protect the next man, and by such actions you will find that you will also educate yourself.

There are some welders that are regarding their profession the same as the ancient Egyptians regarded their alphabet two thousand years ago. The Egyptians taught the reading and writing of their language to the high priests, the Royal family, and to some high powerful nobles. To educate the public was a sacrilege or a crime against their language. Will any one in this room approve of such a method at the present time? Will any one in this room consider his profession the same as an acrobatic stunt? I hope not. Yet we have a good many welders that are considering their welding operations as an extraordinary feature or secret, and are keeping their shops closed, with a sign, "No admittance." This we have got to discontinue, Gentlemen, if you have a desire for progress and of promoting your profession. Let us open our doors and make no secrets of success or failures, and by such actions we will produce an army of competent welders in the mechanical field. Let us show our failures openly; perhaps the next man can find a remedy. Let us standardize our method of welding. Let us teach and be taught the "Safety First" method. Let us discourage home made generators or other improper equipment and supplies. Let us operate our profession on a scientific and uniform basis, and in doing so we will be able to give out accurate and reliable information to our Mechanical Engineers. Only by such actions we can increase the growth of the welding industry and then be able to command a place in the mechanical and engineering field to the highest standard.

I thank you.

*Paper by A. F. Dillon, Sec'y American Acetylene Welders' Association, read before recent meeting.

WELDED SKATING RINK.

To make ten miles of pipe as one continuous pipe—make every joint leak-proof and trouble-proof after buried in ice—was the problem that confronted the builders of the Winter Garden Ice Rink, at San Francisco.

Investigation had shown that in many rinks where ammonia systems were built with screwed fittings, leaks frequently developed in the joints necessitating shut downs for repairs, to the financial loss of the management and displeasure of patrons.

Oxy-acetylene welding not only made the San Francisco Ice Rink leak-proof, but made possible a remarkable saving in the purchase of pipe.

Instead of using new pipe, fifty-five thousand feet of two-inch, "used" boiler tubing was purchased at a saving of twenty per cent over the cost of new galvanized pipe.

Welded Skating Rink.

Every joint in the system was then welded. The floor is 210 ft. long and 90 ft. wide and the welded joints number considerably more than two thousand.

The contractors, The Pacific Pipe Co., claim the work was done by the average welders and that the cost per joint was approximately the cost of an ordinary screw connection.

The rink has been in operation for about six months and the management reports that not a leak has developed in the several thousand joints, which is considered a record among those familiar with skating rink ammonia systems.

The practice of oxy-acetylene welding all kinds of pipe joints is, of course, not new. This process is extensively employed in welding and repairing joints, in gas, oil, steam, air and refrigerating systems. Prest-O-Lite apparatus was used.

The regular monthly meeting of the American Acetylene Welders Association (Jackson, Mich., Chapter), was held on July 5th.

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WOMEN WELDERS.

A long article under the title of "The Little New Trade Union" appearing in the April number of *The Englishwoman* dealing with the status and treatment of women oxy-acetylene welders. This article was extensively quoted (with embellishments) by *The Star* and other dailies.

The article, as quoted by *The Star*, contained several inaccuracies reflecting upon the British Acetylene and Welding Association, and the Secretary was instructed to write to the editor of *The Star*, pointing out the inaccurate nature of the article and the comments of *The Star* thereon. *The Star* inserted the letter from the Association and this was followed a few days later by a disclaimer from Miss Woodward, the teacher at the Women's Welding School.

At the last Council Meeting of the British Acetylene and Welding Association (on May 1st) the article and letters were the subject of discussion, and the President, Mr. Bingham, explained that, in addition to what is narrated above, the steps he had instructed the Secretary to take included the communicating with the Principals of all the Welding Schools with which the Association is connected, and the replies from the various schools are, to say the least, illuminating.

The Council entirely endorsed the President's action, and we venture to say the whole industry is indebted to him for the promptitude with which the aspersions on the Association were combatted.

In order that a proper understanding of the position may be arrived at by our readers, it is necessary to print *The Star* article in its entirety.

"THE LITTLE NEW TRADE UNION."

With a Sidelight on Barrow.

The engineering employers show up extraordinarily badly in the interesting story which is told by M. Lowndes, in the *Englishwoman* for April, of "The Little New Trade Union"—a story of the times which throws a suggestive light on the fascinating riddle of the part which enfranchised woman is about to play in our political and industrial life.

"The little new trade union" is the Women Welders' Union.

In the summer of 1915 there were no welders in London or the South of England, and very few anywhere else in the country. But when the munitions shortage came suddenly into prominence, the Women's Service Bureau (established by the London Society for Women's Suffrage) compiled a list of occupations for which women might be trained; and among them was oxy-acetylene welding for aeroplane manufacture—a process fully employed in Germany, but little known here before the war. It was sought, therefore, to send some selected volunteers to the Northern and Borough Polytechnics' Welding Classes.

Snubbed.

To-day it seems incredible that women should have been refused training for national service in public institutions supported by the ratepayers—but so it was. The Bureau was told that the classes were not for women; that the process (in which 140 women are now doing fully skilled work) was unsuitable for them; that no manufacturer would make use of their services.

The Bureau, however, would not be rebuffed. It started a school of its own, with Miss E. C. Woodward, an accomplished metal worker, as teacher, at her workshop at Notting Hill Gate. It began with one little generator for the acetylene gas, two blowpipes, and six pupils.

Good progress was made. After seeing specimens of the pupils' work, the manager of an aircraft factory near London took six of the women into his shop at 7d. an hour, promising them the same pay as men when their work equalled the men's. The British Acetylene Association remained haughtily deaf to applications for recognition, but some of its members showed more intelligence, and the women pupils found entry into several factories. By January, 1916, it had been clearly established that a new trade had been opened to women.

Employers Break Faith.

But although skilled work of their type was at a premium and men workers were scarce, the refusal of some employers to pay the same rates as men received for similar work (notwithstanding that they had promised to do so, and that it had been so directed in the "dilution" agreement) soon created serious trouble. The women found they were being made to play the part of blacklegs, working at 7d. an hour beside men who were doing the same job for over 1s. an hour. After several unsuccessful attempts to put their case personally, they were told they were "getting quite enough for an unskilled trade," and that "the engineering trade had decided upon a flat rate for women." Even Whitehall repudiated its own "dilution" agreement.

That was how the Women Welders' Union came into being. Fifty of these pioneer women met at the old workshop in Notting Hill Gate, started the union, and laid down that no member should accept a starting wage of under 8d. an hour.

The engineering employers, however, persisted in their attitude. Arbitration was accordingly demanded, and, after much delay, obtained. Miss E. B. Rolfe, secretary of "the new little trade union," represented the women, who were supported by the A. S. E., and the award, given in February this year, triumphantly established their case.

So Much for "Patriotism."

Their victory is satisfactory enough, but it is a humiliating and a melancholy thing that the selfish and unpatriotic attitude of the employers should have put these women to so much trouble and annoyance before they could obtain the honest fulfillment of a pledge. When we hear indignant talk about the iniquities of the strike-threateners at Barrow—also employed in the engineering trades—we may well remember the conclusion of the writer of this article in the *Englishwoman*. She says:

"The promoters of the welding school, in the first instance, feel convinced that without a trade union for the workers harm as well as good would have come out of the enterprise, and that men returning from the army might have found their rates of pay cut by women, who would certainly have seemed to them intruders in their trade. They are also convinced that skilled workers unprotected by combination would in all probability be mercilessly exploited and deprived of their just dues. The young women welders trained at the Notting Hill Gate School have been mostly of the middle class, and were at first averse to the idea of belonging to a union, and some among them slow to perceive its necessity; it was only through their own experience of the determination of the masters to exploit the patriotic zeal of our women citizen that they were led to believe that combination was a necessity.

Editor's Note.—Let us hope the experience of our English allies, so far as a shortage of welders may be concerned, may not be brought home to us. This discussion, reprinted from the Acetylene and Welding Journal (England) illustrates the situation abroad.

"A withering verdict upon the patriotism of the employers!"

This article, part quotation, part comment, was at once challenged by the Association in the following letter, which *The Star* printed. As, however, Miss Woodward has now stated that she did not authorize the article in *The Star*, we suppress, in fairness to her, that part of the reply of the Association referring to her.

Editor's Note.—Welders are so scarce in England that it has been necessary to press women into the service. Under the circumstances this article, taken from the British Acetylene & Welding Journal is interesting.

To the Editor of the Star.

Sir: We note, from the article of April 10th, that it is asserted that the Women Welders' Union approached our Association and they were haughtily snubbed. This is untrue. Far from trying to discourage the teaching of women as oxy-acetylene welders, this Association has done, and will do all in its power to encourage the movement.

This Association (who organized the first oxy-acetylene welding schools in this country) will not issue their certificates of efficiency unless the pupil has passed a proper examination in welding, of the same nature as the men students at the L. C. C. technical schools and other educational authorities in the country, must submit to. The members of the Council of this Association wish the women welders every success, and think that if they do work of the same class, and the same quantity per hour, as the men, they are entitled to the same wages as men.

This Association will be pleased to give certificates to women welders trained by ——— if she will subject her pupils to the same examination as the men welders have to submit to. When it is considered that a bad weld on an aeroplane part may result in the death of flying officers, it is obvious that our demand for a proper examination is not unfair. We believe that, before ——— ——— school existed, this Association was taking steps to train women, and its members have trained at least ten for each one trained by her. Our council are now trying to arrange with various technical schools to include women in their classes, in which case the cost of training will be considerably reduced.

R. G. LUCAS,
(Secretary, The British Acetylene and Welding Association).

103-4, Cheapside.

*The statements in the article ot which this letter refers were reproduced from an article in the *Englishwoman*.

A few days later *The Star* printed the following disclaimer from Miss Woodward:

"THE LITTLE NEW TRADE UNION"

Miss C. E. Woodward, teacher of the Women's Service Acetylene Welding School, to whom our article of April 10th under the above title referred, wishes it to be understood that the article was not authorized by her. We did not, of course, suggest that it was; the statements made were reproduced, as was made clear at the time, from an article in the *Englishwoman*.

In these circumstances the British Acetylene and Welding Association desire (they inform us) to withdraw all the counter remarks about Miss Woodward which they made in the letter to *The Star* published on Saturday.

A further note, on May 1st, appeared in *The Star*, as follows:

With regard to the controversy that has followed our article, "The Little New Trade Union," the *Englishwoman* for May states:

"We learn that neither Miss Woodward nor any other person connected with the Welding school had anything to do with the article which appeared in *The Star*."

There was no mystery about the source of our article. It was derived entirely (as we stated at the time) from an article in the *Englishwoman* for April, which was sent to us by the editor for the favor of notice.

Some of the statements we reproduced the British Acetylene and Welding Association disputed in a letter which we published, and we assume from the present silence of the *Englishwoman* on the question whether its own statements were accurate that an injustice was done to the Employers' Association.

And in this month's *Englishwoman* the following retort is made:

On April 12th a column appeared in *The Star* quoting at some length from an article, "The Little New Trade Union," which was published in our April issue, and also containing comments appropriate to the point of view of the writer. *The Star* communication seems to have caused annoyance to the Secretary of the British Acetylene Association, who on April 21st wrote to that paper unjustly accusing Miss C. E. Woodward, the very competent teacher of the Notting Hill Gate School for Women Workers, of making assertions in *The Star*, which he dislikes.

As the Editor of *The Star* appends a note to Mr. Lucas' letter to the effect that "the statements in the article to which this letter refers were reproduced from an aricle in the *Englishwoman*," it seems well to point out that the only reference in our article to the British Acetylene and Welding Association (to give the full title) is in the following words:

"In January, 1916, . . . the British Acetylene Association, it is true, still turned a deaf ear to applications for recognition, but many of the members of the Association, manufacturers of apparatus, proved themselves more generous, etc."

Miss Woodward has no responsibility for the *Englishwoman* article, which was written by Miss Lowndes, with the full approval of the promoters of the School at 58 Victoria Street. We learn that neither Miss Woodward nor any other person connected with the Welding School had anything to do with the article which appeared in *The Star*.

We are content with the statement of *The Star* "that an injustice was done to the Association," but we look in vain for a similar admission in this month's *Englishwoman*. Some of the statements contained in the *Englishwoman's* article, in so far as they relate to the Association, are hardly in accord with the facts, and a little careful preliminary inquiry would have established this. Also, had the Women's Service Bureau set on foot further inquiries with the various Welding Schools connected with the Association they would have elicited the fact that at Birmingham there was a Welding School quite empty, and this might have led to arrangements being made for training women welders there.

The Northern Polytechnic Institute, Holloway Road, Welding School, as is well known, is fully occupied training welders for the army, but that they are not hostile to the principle of admitting women to the classes is proved by the admission of the instructors and students from the Notting Hill Schools to the series of lectures on oxy-acetylene welding.

Some typical replies from the various Welding Schools are as follows:

Glasgow: Royal Technical College.—

"All classes of this college are open to women on exactly the same conditions as to men. We have trained scores of women for munition work in oxy-acetylene welding."

Leeds: Central Technical School.—

"We have no objection to admitting women to the welding classes. The only difficulty as regards our evening classes lies in the fact that up to now the number of applications for admission has always exceeded our available accommodation. As a matter of fact, since January we have been training women in the day time as oxy-acetylene welders by arrangement with the Ministry of Munitions."

Manchester: Municipal School of Technology.—

"The School of Technology is prepared to admit women to the welding classes on the same conditions as men."

London: Northern Polytechnic Institute.—

"At present our shops are quite full with men in the day time, and with munition classes for men in the evening, so that I am afraid we cannot do anything at the moment, but, possibly, when one of the present men's classes finishes, we might substitute one for women."

From these replies it will be seen that neither the Association nor the welding schools are by any means hostile to the admission of women.

The point of difference is as to qualification, and with such conditions as necessarily obtain in oxy-acetylene welding, we think the Association would be false to its trust if it were to waive its requirements, because these are entirely in the interests of safety, both for the worker, and in many cases, for the flying men's lives.

With regard to the question of wages—the Association has always taken the line that it is not within its province, although we have no doubt that in cases of disputes their good offices can be relied upon.

We notice that the writer of the *Englishwoman* article states:

"While the Amalgamated Society of Engineers had shown themselves willing that women should be introduced into their trade to perform work hitherto entirely confined to men, it is obvious that they could not permit the cutting of wages in favor of the employer by such new workers. The women themselves clearly understood the situation, and were wholly averse to enter as 'blacklegs' into a new position in the labor market. They based their claim to a proper wage upon the principle laid down in the circular, and earnestly deprecated any desire to undercut men or interfere in any way with the position won by the workers through successful combination.

"It may interest the Women's Service Bureau to know that for some considerable time we have had a succession of men welders calling at these offices, and complaining that they are being discharged in order to make room for women."

Again, the *Englishwoman* article states that two London Polytechnics informed the Women's Service Bureau that "the process was unsuitable for women, and those in control declared that no manufacturer would make use of their services." The replies of the welding schools to the Association's letter do not bear out that statement, quite the reverse.

It will be seen from the letter of the Association to *The Star* that the welding industry commits itself to the doctrine of equal pay for men and women for equal service, and promises Certificates of Proficiency to women under certain necessary conditions. That being the case, it appears to us that the best course for the women to pursue is to secure the certificate of the Association.

These certificates are not lightly awarded, but there can be no possible doubt that it is in every welder's interest to secure one. Unfortunately, many women welders have never been through a course of instruction at any school whatsoever. They can take it from us that, if they wish to continue in the industry after the war, it will be well worth the trouble to qualify. In present circumstances we can quite understand the remark of one of them—that after the day's work is done, they are too exhausted to attend any lecture or instruction classes. That is one of the first things that should be altered immediately the present extreme pressure is removed.

ELECTRIC RAILWAY SHOP WELDING*

An Extraordinary Variety of Repairs Now Made in Shops. Process Convenient in Heavy Truck Repairs.

A panacea for innumerable ills of electric railway equipment has been supplied by the oxy-acetylene welder and cutter. Perhaps no other tool introduced into electric railway repair shops during recent years has made possible greater economies, since its ability to reclaim worn or broken parts has effected large savings in material without increase in the payroll and has made it unnecessary to purchase and carry in stock many of the most expensive repair parts. In factfi in many instances, storerooms have even been replenished from the scrap heap.

*From the Electric Railway Journal.

Armature and Axle Bearing Housings Reclaimed

It has been the experience of the Terre Haute, Indianapolis & Eastern Traction Company, of which M. F. Flatley is master mechanic, that armature bearing housings and frame heads can be successfully welded, and that in many cases even more satisfactory results can be obtained than if new parts are purchased. The reason for this is that the repaired casting can be over-built to compensate for the wear in the frame head, thus insuring a close fit when the parts are assembled. Since the wear is caused by movement between the frame and the housing, if a new housing is installed the difficulty is only partially remedied, because the new housing cannot be held tightly in place in the worn frame. In this case the bearing housings have their worn surfaces restored by building on new metal, after which the housings are turned in the lathe to about 0.01 in. larger than a new housing to fit the old frame. A cast steel rod is used in the welding operation so that cast steel is built on cast steel, hence no difficulty is experienced in turning the housing in the lathe. The average cost of thus welding and machining a housing is $2.82, whereas the cost now is $8.60.

Reference has been made to the building up of worn axle seats for motors, but the Terre Haute, Indianapolis & Eastern Railway is going one step further by reclaiming worn axle caps from the scrap pile. This has been accomplished in many instances by filling up the dowel-pin holes and redrilling them at a relatively small cost. Previously some of these axle caps had been reclaimed by bushing the worn holes and providing new dowel pins, but the bushings frequently worked loose and wore into the axle cap in the same way as the dowel did before the bushing was inserted. The dowel-pin hole would finally become so badly worn that it would be impossible to insert a bushing large enough to fill the hole completely and thus prevent movement. When this occurred the service life of the axle cap was ended, and in cases of this kind autogenous welding was the only possible means of reclamation.

The average cost of renewing the two dowel-pin holes with the oxy-acetylene welder is 70 cents, as compared with a cost of $10.03 for a new axle cap. This represents a saving of $9.33, neglecting scrap value, and the finished job should increase the life 100 per cent, because the welded metal is cast steel of the same quality as that in the axle cap. As a precaution against the dowel-pin where in reclaimed axle caps the caps are bolted in place, the caps and motor housings numbered in pairs, and each bearing is calipered for size. The cap is then planed off to reduce the bore so that when the bolts are drawn up the bearing will be clamped tightly in the housing, and thus the dowels are relieved of the work of holding the bearing secure. In one of the accompanying illustrations an axle cap is shown ready for welding and another is shown fully restored and ready for service.

Old armature bearings are also repaired very successfully by welding. If the collar is worn down it is built up with Tobin bronze and turned in a lathe to the standard size. If the bearing is cracked, a V-shaped groove is cut along the crack, and this is filled with bronze by the welder. Experience has demonstrated that bearings repaired and reclaimed in this manner are as good as new, and the average cost of repairing them, for both the pinion and the commutator ends of an armature, is $1.20. A new commutator-end bearing costs $4.19 and a new pinion-end bearing costs $7.78. The total average saving made by reclaiming a bearing of the type used by this company is thus $10.57, and the wear life is increased practically 100 per cent.

Coupler Knuckles Lengthened

A very unusual application of welding that has been made by this company is found in its plan of lengthening coupler knuckles. Abnormal track surface conditions, truck-spring deflections and wheel wear had caused cars to uncouple, in a number of instances, indicating that the 11-in. face of the knuckles in the M. C. B. radial car couplers was too short. The difficulty became especially noticeable with interurban cars in train service at sharp changes in grades, particularly at approaches to bridges and in the city streets. Although the couplers and car heights were carefully examined and corrected to eliminate coupler failures, the mechanical department was unable entirely to overcome the trouble. After trying various remedies to no avail, it was decided to increase the length of the knuckle face from 11 in. to 13 in., and to safeguard the service it was considered desirable to make the change promptly. An investigation of the time required to obtain new knuckles indicated that about the only way to do so would be to make new patterns and have the knuckles cast at a local foundry. Such a move, however, entailed scrapping the old knuckles in addition to paying for the special knuckles. As an experiment one of the standard 11-in. knuckles was lengthened by welding on pieces with oxy-acetylene, and this proved so successful that it was decided to lengthen all the knuckles with the welder, the work being done at an average cost of $2.26 per knuckle.

The following procedure was adopted: A templet was first cut from a piece of sheet steel to the exact shape of the top of one of the standard knuckles, and from this templet pieces were cut from 1-in. by 3-in. steel bars with the oxy-acetylene cutting torch. These pieces were afterwards forged to fit the ends of the knuckle, to insure perfect contact, about 1 in. of the small end of the forging being beveled simply to improve the appearance of the finished knuckle. Auxiliary knuckle pin holes were then drilled through both of the forgings, and they were pinned to the casting. As an extra precaution against any chance of failure and to reinforce the weld, an additional hole ½ in. in diameter was drilled through each forging and into the knuckle for about 1¼ in., a small pin being driven tightly into the hole. This held the piece firmly in position during the welding operation, and assisted in strengthening the weld.

After the knuckle and forgings had been assembled, the entire casting was placed in a blacksmith's forge, and one end was brought to a white heat. In this condition, the forging on that end was rapidly welded to the casting, the cast steel rod being melted as far down in the joint as possible, and the metal being gradually carried up to the working face of the knuckle. When the weld was completed on one end the knuckle was again placed in the forge, where the other end was heated and subsequently welded in a like manner. This preheating of the knuckles is considered to be a very important part of the operation, because when it is properly done the amount of gas necessary to make the weld is reduced about 50 per cent.

After the welded casting became cooled, all metal projections were chipped off with a chisel and hammer, and the face of the knuckle was finished with a file or portable emery wheel. The need for finishing, however, could be practically eliminated by the skillful use of the torch during the welding operation. An examination of a number of knuckles lengthened in this manner showed little or no evidence of how the work was done, as there was no line of demarcation indicating where the weld had been made. The distribution of the cost of the work follows:

Blacksmith labor	$0.28
Helper's labor	.18
Machinist's labor	.20
Welder's labor	.60
10 lb. of 1-in. x 3-in. steel	.18
1 lb. of filling rod	.10
18 cu. ft. of acetylene gas	.36
24 cu. ft. of oxygen	.36
Total	$2.26

The original cost of the 11-in. knuckle was $4.50, and if the mechanical department had decided to buy special knuckles the cost would have been considerably more than this. In addition, there would have been the delay necessary to prepare the special pattern and to obtain the steel castings, which are scarce and high-priced owing to the present conditions in the steel industry.

Innumerable repair jobs which, under ordinary conditions, would have been difficult, have become quite easy when the oxy-acetylene cutting and welding torches were brought into play. When this outfit was purchased, there were included several tips for cutting different thicknesses of metal and a special rivet-cutting torch. The latter has been found especially useful in removing and renewing damaged members in the steel cars, as rivet heads may be cut at the rate of three per minute.

In one instance a 7-in., 13½-lb., channel intermediate sill in an all-steel express car was badly twisted in a wreck. This channel was bent at right angles and the needle beam that was framed into it was also badly distorted. Under ordinary conditions it would have required two or three days to cut out this bent sill and needle beam with a hack-saw and chisel. Moreover, two sets of splice plates would have been necessary to replace the damaged section of the intermediate sill in the car-body underframe. With the oxy-acetylene cutting torch, however, the damaged section of the channel was quickly cut at two places and removed. The bent sill and needle beam were taken to the forge shop and straightened, and in a very short time they were ready to be replaced in the underframe. Instead of using splice plates where the bent section of the intermediate sill joined the sections from which it had been cut, an oxy-acetylene weld was made in twenty minutes, about 50 cents' worth of gas being used in the operation. Only about ten minutes were required to cut off the rivets and to cut through this channel in two places, when it was removed from the underframe. Experience has shown that it costs about $1 an hour for the gas used in various welding operations, the quantity depending upon the size of the tip employed.

Innumerable other small cutting operations are necessary in steel cars in both construction and repair work. For instance, instead of suspending the conduits beneath the cross-bearers in the underframe, slots are cut through the webs of these members and the conduits passed through them. Damaged side plates are quickly removed by using the rivet cutter, which cuts the head of a rivet without damaging the plate. After the plates have been straightened in the blacksmith shop they are restored to their original position and welded in place. Similarly, many forging operations have been superseded merely by cutting out the parts from metal of the required thickness. For instance, body brake-levers, which were formerly made from 1¼-in. steel bars by forging them to the proper dimensions, are now cut from 1⅛-in. plates. By this method the cost of manufacturing the levers is greatly reduced, since all that is required after the levers have been cut to a templet is to drill the necessary holes.

Worn Journal Boxes Reclaimed

Prior to the advent of the oxy-acetylene welder worn journal boxes had to be scrapped and replaced with new ones. Thise waste of high-price metal has been obviated by the Michigan Railway provjding new ⅛-in. sheet-steel chafing plates and welding them in the pedestal ways. Two 6-in. by 11-in. malleable iron journal boxes, one of them being worn

and the other having been repaired with the oxy-acetylene welder. As it has been found very difficult to weld malleable iron with malleable iron, Tobin bronze is employed to cheapen this operation, and the metal produces satisfactory results. The first cost of one of the journal boxes shown in the accompanying illustartion is $6.25, while the cost of welding on new chafing plates is only 50 cents. Although the chafing plates have been riveted on successfully in some instances it has been found very difficult to make them oil-tight, whereas when the plate is welded in place this requirement is readily met.

A similar case occurred in connection with a broken base on one of the Michigan Railway's pneumatic illustrations, the base, which is made of cast iron, was cracked across one side, and to weld it cast iron metal was poured into the crack. The cost new of one of these bases is approximately $25, but the cost of material, labor and gas for welding was about $1. In addition to the saving made by reclaiming the casting, it was important that the base be restored to service in a short time, and the welder readily met this condition.

Again, a casting which was used in connection with the third rail shoe mechanism, and which was broken in service, was practically impossible to replace promptly because of slow deliveries on steel castings. To restore the casting to service three welds were required, two across the end of the yoke formed by the casting and one where this yoke connects with the main casting. In the instance cited the piece broken out of the end of the yoke was lost along the roadway. In was necessary to prepare a short section of cast steel to take its place and weld it to the two sides of the yoke. The labor, materials and gas used in completing this job cost 50 cents. On another occasion a coil from a Peter Smith hot water heater had burned out or burst by freezing and the oxy-acetylene welder was employed to restore it to service. At the time the repair was made the possibility of saving was not as important as the prompt provision of heat for the car. Still, the cost new of one of these coils was approximately $75, and the cost of welding was only $3. This work was very successfully accomplished, and the welded coil has been in service for several months. The saving made in this case was $72, and it was unnecessary to deduct anything from this figure for scrap value because the old tube was practically worthless as scrap.

Quick Repairs in Chattanooga

An example of quick repair work done in the shop of the Chattanooga Railway & Light Company is shown in one of the accompanying illustrations. In this case the repairs were made to a sandbox which had been broken near the bottom at the spout. As sandboxes rarely break, and extra ones are not kept on hand, the broken spout, under old conditions, would have meant either running the car without sand or else keeping it out of service for four or five weeks, because at present it is difficult to obtain electric railway material promptly after it is ordered and the cost of patching the break would have been all out of proportion to the value of the casting. With the oxy-acetylene welder, however, these difficulties disappeared.

The acetylene welding outfit is used very generally by this company for repairing heavy broken parts, such as truck frames, drawheads, brake hangers and body bolsters, and it is frequently used even for such odd jobs as repairing broken stoker castings. Recently one of the company's cars had a broken brake hanger carrier of ⅞-in. by 4-in. steel which was restored without taking the truck from under the car and even without taking the brake hanger off the truck. Its removal and welding in the blacksmith shop would have cost approximately $3, whereas the actual expenditure was 50 cents. Several broken truck frames have been repaired at a cost that averages between $1.50 and $3, the replacement

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By S. W. MILLER

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Ten years ago the oxy-acetylene method of welding and cutting metals was hardly more than a laboratory process, but in the course of these few years it has become one of the most important of the methods in the metal-working industries. Much has been published relating to this process, but a great deal of that which has been placed on record in the past has been descriptive of odd jobs. It is, therefore, believed that the present volume, dealing in a more systematic manner with the principles and practice of the art of oxy-acetylene welding, will be of considerable value to those engaged in the metal trades.

The information here presented on the subjects of oxy-acetylene welding and cutting has been mainly furnished by S. W. Miller, proprietor of the Rochester Welding Works, whose wide experience in the practical application of the process, and whose success in the work, vouch for the reliability of the information here placed on record. The experience of the author in the oxy-acetylene welding field has been unusually extensive, but having been mostly on repair work, he has written especially for those engaged in a similar line. A great deal of the work done with the oxy-acetylene welding torch is on repairs, and while there are also a great many applications of it in manufacturing work, such applications are more or less special in each case, and sometimes require a great deal of experimenting before success is attained. The general principles here presented, however, apply equally to repair and manufacturing work. This volume describes the equipment required for oxy-acetylene welding and cutting, deals in detail with methods used in welding cast iron, malleable iron, steel, copper, brass, bronze, and aluminum and gives in addition, special attention to the welding of sheet metal, tank welding, boiler repairs, etc., as well as to the subject of lead burning, which is a special kind of autogenous welding.

The book contains twelve chapters headed as follows:

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Orders filled Day and Night

Superior Oxy Acetylene Machine Co., Hamilton, Ohio

of such pieces under ordinary methods involving a cost that ranged between $40 and $50.

The heaviest work that is done at Chattanooga with the oxy-acetylene welding apparatus consists in repairs to body bolsters which are constructed of ⅞-in. steel plate 9 in. wide. These plates are bent at right angles at each end to form the support for the side sills, and it has been found that they display a tendency to break at the inside of the bends. To repair them originally cost $10, but with the oxy-acetylene flame the operation of repairing the break costs approximately $2.50.

W. S. Henry, master mechanic, Chattanooga Railway & Light Company, states that the best way to train an operator appears to be merely to turn him loose with the machine after he has learned to regulate the flame. At Chattanoga originally a point was made of having the operator make one or more practice welds each day for some weeks so that his experience would be regularly developed without waiting for the occurrence of emergency jobs which form the greater part of the work that is done with the apparatus.

WELDERS AT WAR.

As may have been expected, the war has not found the welding trade "out on the end of a limb" It will be some time before we learn the extent to which members of the trade have volunteered their services, but the known volunteers up to this time reflect great credit on the craft.

Probably the best known welding expert to volunteer is Mr. Paul Pleiss, Secretary and Director of the Burdett Oxygen Co., and Burdett Manufacturing Co., who has been commissioned a First Lieutenant in the Aviation Section, Signal Officers Reserve Corps. Lieut. Pleiss will be detailed to active service at once. Among other employes of his Company are the following:

C. N. Owen, manager, Chicago Plant, Company 4, Fort Sheridan; J. J. McCormick, director of Burdett Co., Officers' Training Corps, Fort Sheridan.

Mr. D. B. Browne, Goldschmidt Thermit Co. (Metallurgical Eng.), is at the Plattsburg Training Camps. He will enter the Heavy Artillery Corps. Mr. L. I. Grinnell, same company, has entered the Cavalry Division. The Goldschmidt Thermit Co. has also furnished several men for various other divisions of the Army and Navy.

Mr. M. Keith Dunham, who may be said to be one of our best known authorities on the subject of welding, has just taken his examination and expects to be called to the colors in the near future. Mr. Dunham is well qualified to stand at the head of the army's staff of welding experts.

We don't like to talk about ourselves, but we are a veteran officer of a previous war, the Spanish-American. L. B. Mackenzie, editor of The Welding Engineer, has taken his final physical examination. We can't see very well, but our teeth are excellent. We have offered to bite the Germans, if necessary.

Two members of the staff of the Universal Oxygen Co. are with the colors, Messrs. Godez and Spratt. They are both veterans of the Mexican trouble.

So many Westinghouse men are in service that we are unable to list them, There are more than 300. Where duty calls you always find Westinghouse.

The Michigan State Auto School, Detroit, has furnished a number of men, not only for the welding department, but for other branches as well. A diploma from this school usually means a rank not lower than sergeant.

Bierman-Everett Foundry Co. have contributed a number of men. Several more are on the eve of departure.

F. A. Hardy & Co. have six men at the front. Let's hope they have the "Hardy" goggles and never miss the mark.

The Oxweld Railroad Service Co. has seven men in service in various branches of the army.

No doubt practically every concern doing business in the welding trade has contributed men or materials to the cause. Before we are finished with this war we venture the opinion that the welding industry will be well represented in the army and navy.

ANOTHER NEW BOOK.

The literature of oxy-acetylene welding is being enriched these days by several new books on the subject of welding. The latest contribution is "Oxy-Acetylene Welding Practice," by Robert J. Kehl, M. E., a consulting mechanical engineer of Chicago. The publisher is the American Technical Society, Chicago. Copies may be had from *The Welding Engineer* at $1.00 each. There are 102 pages, with index, covering every phase of welding. The illustrations are profuse and will prove of great service to the novice.

AMERICAN TORCHES
Set the Standard in
OXY-ACETYLENE
Welding and Cutting Apparatus

Our Model O. W. Outfit is designed for heavy work and will withstand the constant service that the blacksmith and boiler shop demand.

An injector type torch recognized as the most efficient and due to the exactness of construction cannot be made to backfire. Large welding jobs that are entirely out of the range of the ordinary welding outfit are successfully and easily accomplished with the AMERICAN positively non-backfiring torch.

Write for descriptive booklet

AMERICAN WELDING CO., Inc.
2724 Michigan Ave. CHICAGO, ILLINOIS

Classified Ads

Help Wanted—25c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—50c per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

Wanted—Salesman to solicit subscriptions to *The Welding Engineer*, or furnish names of possible readers. Compensation good. Correspondence confidential. Write Mackenzie.

For Sale—Clayton Oxygen Compressor, 3 stage machine for compression up to 2,000 pounds. Displacement per minute 35 cubic feet at 150 revolutions per minute; a first-class machine in strictly fine condition for immediate shipment. Address D-140, care *The Welding Engineer*.

Wanted: A first-class oxy-acetylene welder for all kinds of auto work, aluminum especially. There is an especial advantage in this position. Good hours, good salary and rapid advancement after proving worth. Give full particulars in first letter or no notice taken. Address Welder, Box 93, Copley Sq. P. O., Boston, Mass.

Wanted: First-class oxy-acetylene job welder. State experience in detail and salary expected. Address Eastern, care *The Welding Engineer*.

Don't be
A Business Slacker

Right now the man who allows fear to paralyze the hand he writes checks with is just as dangerous to his country as a deliberate crank who throws a bomb

The Premier Motor Corporation believes that the business slacker here at home is our one real enemy—far more of an enemy than the Kaiser, because the Kaiser cannot get at us.

If you cannot thrust a bayonet, you can at least drive your business harder than you have ever driven it before and thus help create the imperative prosperity with which alone this war can be won.

It betrays weak-mindedness to think of diving headlong into a period of panic, penance, abject fear and hysterical economy.

The man who sneaks down and buys a marriage-license life preserver is not the worst breed of slacker. Conscription will take care of him. But for the business slacker there is no law but his own conscience.

The man who destroys business takes the bread out of the mouths of thousands.

No matter what comes—

Don't be a Business Slacker.

* * *

Right now is an almighty good time to take the bull by the horns and look him square in the eye.

America is at war. It is a big war—a very big war. It may be a long war. And when we try to imagine what may happen no one can blame us for looking serious.

But there is absolutely no reason for being scared, or, in a business way, even apprehensive.

We cannot avoid the firing line—we can avoid the bread line.

WAR IS TRANSIENT—THE UNITED STATES IS PERMANENT

The demands on us will be great—but our resources are inexhaustible. The United States today has the larger part of all the real money in the world. But money is just like a man—if it is inactive it is useless. While we are talking about making our factories and our farms *produce*—let's not forget to keep our money producing. We will encounter serious problems, but American ingenuity and inventive genius is equal to any emergency.

We are going to win this fight because we are on the side of *right*—and when we come out of it *we are Going To Be a Real Honest-to-God Nation.*

Meanwhile, what about business?

The real barometers of America's business are the smoke stacks to her factories—her dinner pails—and the mouths of her one hundred millions.

AMERICA IS GOING FULL SPEED AHEAD—DON'T LET ANYBODY TALK YOU OUT OF THAT

Even if America desired hard times, the world would refuse her the wish. We have been conscripted as the world's kitchen, the world's shipyard, the world's bank—*the World's General Business Manager—Carte Blanche.*

America is bound to be prosperous. That's her part in the war. Someone must keep wealthy enough to meet this war's pay roll. That's our job. As a result, the great mass of men, women and children in this country can no more avoid getting money out of this present emergency than a lily in the rain can avoid getting wet.

Get these facts through your head, for they are the only true facts on which you can base your business plans.

AMERICA HAS TAKEN WHAT AMOUNTS TO A SEVEN-BILLION-DOLLAR ORDER

And, mind you, this is only the first of many such orders. Seven Thousand Million Dollars' worth of shoes, canned goods, harness, motor trucks, automobiles, ships, blankets, clothes, guns, munitions and *what not* must be manufactured and delivered. Who gets this *seven billion?*

If you are a merchant, every customer on your books will get a piece of it. If you are a manufacturer or mechanic, you yourself will get your part of it.

There is going to be no *non-productive* labor or capital in this country. Everybody *must* produce—which means that everybody *must* be on somebody's pay roll.

For at least three years America cannot avoid being the most prosperous nation the world ever saw.

America's Wealth is About to be Redistributed and Put in the Hands of Our People.

—not in the hands of the hoarding few.

When our people get money they have the courage to spend it.

So look out for big business—*Tremendous and Inevitable Big Business*—and get ready to take care of it when it comes.

We assure you that the Premier Motor Corporation, for one, proposes to keep right on building and selling and creating its share of the wealth with which this war must be fought, and we have reason to believe that the whole motor car industry feels exactly the same way about it.

The biggest week Premier ever had was last week—our biggest day so far was yesterday.

—and it looks now as if we had only started—proving that honest merit still wins. Premier, with its unheard-of advantages and its unquestioned quality, consitutes real economy at $1985.

If you have thought of buying a car this year, go ahead and buy it.

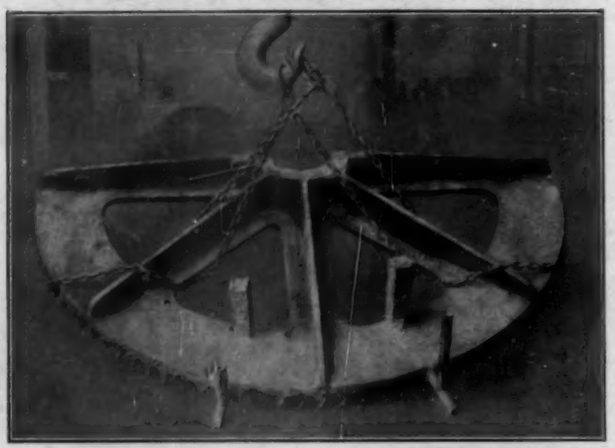
* * *

Meanwhile, remember that the man who allows fear to paralyze the hand he writes checks with is as dangerous to his country as the deliberate crank who throws a bomb.

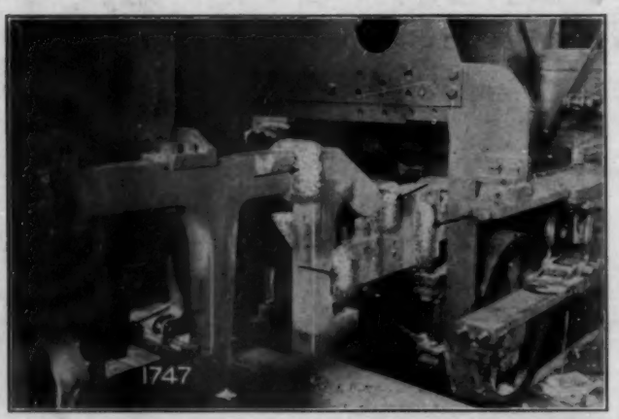
Premier Motor Corporation.

We are republishing without expense to the Premier Motor Corporation this advertisement which appeared in N. Y. Times. It is so good that we do not want our readers to miss it.

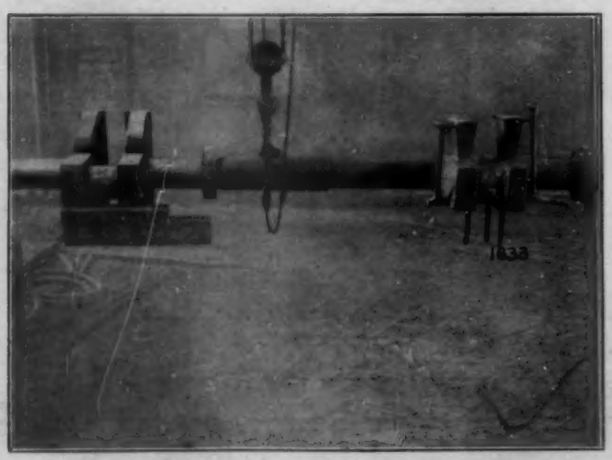
New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.



Large bevel gear on which two new teeth and crack have been repaired.



Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



New crank pin welded in by the Thermit Process.

Thermit Does the Heavy Welding and Does It Right

The Thermit Welding Process is the only one that is best adapted to repairing of heavy sections (see illustrations).

Thermit will repair such sections quickly and economically. Many serious delays have been avoided from the use of Thermit Welding and saved thousands of dollars in time and expense.

If you have a breakdown

wire or telephone our nearest office and we will proceed at once for arranging the shipment of materials and send an expert to supervise the repair.

We have an eighty-page pamphlet devoted exclusively to this class of work, which is known as pamphlet No. 1779, and tells how the work is executed and how you can do the work yourselves.

Goldschmidt Thermit Co.

Equitable Bldg., 120 Broadway
New York

329 Folsom Street, San Francisco — 7300 South Chicago Avenue, Chicago
103 Richmond Street, W., Toronto, Ont.